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TRANSACTIONS

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ERRATA.

TRANSACTIONS.

Page 9, line 7 from bottom, for *multas paleas* read *multis paleis*.
Page 38, line 2 from top, *for* July 3th *read* July 8th.
Page 45, line 28 from top, for *regentsteinensis* read *regensteinensis*.
Page 51, line 4 from bottom, for *cœrulea* read *cærulea*.
Page 94, line 5 from bottom, for *Epinephale* read *Epinephile*.
Page 109, line 5 from bottom, for *Cephanodes* read *Cephonodes*.
Page 113, line 16 from bottom, for *charonia*, Dru. read *canace*, Linn.
Page 115, line 17 from top, for *undularis* read *caudata*, Butl., an aberration with a broad fulvous shade from the base parallel to the inner margin, approximating to the colouring of the ♀.
Page 125, line 7 from top, for *Calysime* read *Calysisme*.
Page 127, line 24 from top, for *ariadne* read *minorata*, Moore.
Page 128, last line but two, for *daretis*, Hew. read *drypetes*, Hew.
Page 129, lines 5, 6, 7 from top, insert a comma after "took," and *delete* "a single . . . also." The sentence will then read—. . . "I took, settled on a leaf . . . , a specimen . . . ."
Page 136, line 14 from top, for *shakra* read *schakra*.
Page 378, line 22 from top, for *phlœas* read *phlæas*.
Page 400, line 21 from top
Page 404, line 6 from top
Page 406, line 19 from top
} *for* Mount *read* Md.
Page 406, line 2 from bottom
Page 408, line 22 from top
} *for* Bon *read* Bou

PROCEEDINGS.

Page xxxv, line 16 from top, and line 26 from top, for *Syricthus* read *Syrichthus*.
Page xliii, line 13 from top, for *G. album* read *C. album*.
Page liv, line 2 from top, for *Læmophilus* read *Læmophlæus*.

THE

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OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR

1905.

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CONTENTS.

PAGE

Errata ii
Explanation of the plates viii
List of Fellows... ix
Additions to the Library xxiv

MEMOIRS.

I. The Life History of *Gerydus chinensis*, Felder. By JOHN C. W. KERSHAW, F.L.S., F.E.S. 1

II. Butterfly-destroyers in Southern China. By JOHN C. W. KERSHAW, F.L.S., F.E.S. 5

III. On *Erebia palarica*, n. sp., and *Erebia stygne*; chiefly in regard to its association with *E. evias*, in Spain. By THOMAS A. CHAPMAN, M.D., F.Z.S. 9

IV. Another Entomological Excursion to Spain. By GEORGE CHARLES CHAMPION, F.Z.S., and THOMAS ALGERNON CHAPMAN, M.D., F.Z.S.; with descriptions of two new species of *Hemiptera*, by Prof. O. M. REUTER 37

V. The Egg and Early Larval Stages of a Coreid Bug, probably *Dalader acuticosta*, Amyot et Serv.; with a note on its Hymenopterous Parasite. By NELSON ANNANDALE, B.A., Deputy Superintendent of the Indian Museum, Calcutta 55

VI. Notes on the Butterflies observed in a tour through India and Ceylon, 1903–4. By G. B. LONGSTAFF, M.D., Oxon. 61

VII. The genus *Criocephalus*. By D. SHARP, M.A., F.R.S. With Notes on the habits of *Asemum striatum* and *Criocephalus ferus*. By F. GILBERT SMITH 145

(VIIa. The Habits of *Asemum striatum* and *Criocephalus ferus*) 165

VIII. On the matrivorous habit of the species *Heterogynis*, Rmbr. By T. A. CHAPMAN, M.D., F.Z.S. 177

IX. Descriptions of some new species of *Satyridæ* from South America. By FREDERICK DU CANE GODMAN, D.C.L., F.R.S., etc. 185

X. Additions to a knowledge of the Homopterous Family *Cicadidæ*. By W. L. DISTANT 191

XI. On the Pupal Suspension of *Thais*. By T. A. CHAPMAN, M.D., F.Z.S. 203

XII. Notes on New Zealand *Lepidoptera*. By E. MEYRICK, B.A., F.R.S., F.E.S. 219

XIII. On three remarkable new genera of *Microlepidoptera*. By SIR GEORGE F. HAMPSON, Bart., B.A. 245

PAGE

XIV. Descriptions of some new species of *Diurnal Lepidoptera*, collected by Mr. Harold Cookson, in Northern Rhodesia, in 1903 and 1904. By Herbert Druce, F.L.S. *Lycænidæ* and *Hesperiidæ*, by Hamilton H. Druce, F.Z.S. 251

XV. *Pseudacræa poggei* and *Limnas chrysippus;* the numerical proportion of mimic to model. By Horace A. Byatt, B.A., F.E.S. With a note by Professor E. B. Poulton, D.Sc., M.A., F.R.S., etc. 263

XVI. A Monograph of the genus *Ogyris*. By George T. Bethune-Baker, F.L.S., F.Z.S. 269

XVII. The structure and life history of *Psychoda sexpunctata*, Curtis. By John Alexander Dell, B.Sc. Communicated by Prof. L. C. Miall, F.R.S., F.E.S. 293

XVIII. New African *Lasiocampidæ* in the British Museum. By Prof. Chr. Aurivillius, Hon. F.E.S., F.M.Z.S., etc. 313

XIX. Memoir on the *Rhynchota* collected by Dr. Arthur Willey, F.R.S., chiefly in Birara (New Britain) and Lifu. By G. W. Kirkaldy, F.E.S. 327

XX. The Blind *Coleoptera* of Australia and Tasmania. By Arthur M. Lea, F.E.S., Government Entomologist, Tasmania ... 365

XXI. On a Collection of Butterflies and Moths made in Marocco, in 1900-01-02. By E. G. B. Meade-Waldo. Communicated by H. J. Elwes, F.R.S., etc. 369

XXII. A new species of the Hymenopterous Genus *Megalyra*, Westwood. By J. Chester Bradley, Ithaca, N.Y., U.S.A. Communicated by Col. C. T. Bingham, F.Z.S. 395

XXIII. *Hymenoptera Aculeata* collected in Algeria by the Rev. A. E. Eaton, M.A., F.E.S., and the Rev. Francis David Morice, M.A., F.E.S. Part II. *Diploptera*. By Edward Saunders, F.R.S., etc. 399

XXIV. On the Ichneumonidous Group *Tryphonides schizodonti*, Holmgr. With descriptions of new species. By Claude Morley, F.E.S. 419

Proceedings for 1905 ... ... i—lxxvi
Annual Meeting lxxvii
President's Address lxxxiii
General Index cxii
Special Index cxviii

EXPLANATION OF THE PLATES.

Plate I.	See page	4	Plate XII.	See page	218
Plates II to VI.	,,	34—35	Plate XIII.	,,	262
Plate VII.	,,	54	Plate XIV.	,,	268
Plate VIII.	,,	59	Plate XV.	,,	292
Plate IX.	,,	164	Plate XVI.	,,	326
Plate X.	,,	190	Plate XVII.	,,	363
Plate XI.	,,	202	Plates XVIII, XIX.	,,	393

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1900 Flemyng, The Rev. W. Westropp, M.A., *Coolfin, Portlaw, Co. Waterford.*
1898 † Fletcher, T. Bainbrigge, R.N., H.M.S. "Sealark," Special Service.
1883 † Fletcher, William Holland B., M.A., *Aldwick Manor, Bognor.*
1905 Floersheim, Cecil, 16, *Kensington Court Mansions*, S.W.
1885 Fokker, A. J. F., *Zierikzee, Zeeland, Netherlands.*
1900 Foulkes, P. Hedworth, B.Sc., *Harper-Adams Agricultural College, Newport, Salop.*
1898 Fountaine, Miss Margaret, 7, *Lansdowne-place East, Bath.*
1880 Fowler, The Rev. Canon, D.Sc., M.A., F.L.S., *Earley Vicarage, near Reading.*
1883 Freeman, Francis Ford, *Abbotsfield, Tavistock.*
1896 Freke, Percy Evans, *Southpoint, Limes-road, Folkestone.*
1888 Fremlin, H. Stuart, M.R.C.S., L.R.C.P., *Mereworth, Maidstone.*
1903 French, Charles, F.L.S., Government Entomologist, *Victoria, Australia.*
1891 Frohawk, F. W., *Ashmount, Rayleigh.*
1855 * Fry, Alexander, *Thornhill-house, Dulwich Wood Park, Norwood*, S.E.
1900 Fryer, H. Fortescue, *The Priory, Chatteris, Cambs.*
1884 Fuller, The Rev. Alfred, M.A., *The Lodge, 7, Sydenham-hill, Sydenham*, S.E.
1898 Fuller, Claude, Government Entomologist, *Pietermaritzburg, Natal.*
1904 Furnival, Thomas F., 63, *Coleman-st.*, E.C.

1887 Gahan, Charles Joseph, M.A., *Whyola, Lonsdale-road, Bedford Park*, W. ; and *British Museum* (*Natural History*), *Cromwell-road*, S.W.
1892 Garde, Philip de la, R.N., *Manor-house, Shaldon*, nr. *Teignmouth.*
1890 Gardner, John, 6, *Friars-gate, Hartlepool.*
1901 † Gardner, Willoughby, F.L.S., *Deganwy, N. Wales.*
1899 Gayner, Francis, *Oxshott, Surrey.*
1899 Geldart, William Martin, M.A., *Trinity College, Oxford.*
1902 Gillanders, A. T., *Park Cottage, Alnwick.*
1904 Gilliat, Francis, B.A., *Forest Dene, Worth, Sussex.*
1865 † Godman, Frederick Du Cane, D.C.L., F.R.S., F.L.S., F.Z.S., *South Lodge, Lower Beeding, Horsham*; 7, *Carlos-place, Grosvenor-square* ; and 10, *Chandos-street, Cavendish-square*, W.
1890 Goldthwait, Oliver C., 5, *Queen's-road, South Norwood*, S.E.
1886 † Goodrich, Captain Arthur Mainwaring, *Lennox Lodge, Malvern Link, Malvern.*
1904 Goodwin, Edward, *Canon Court, Wateringbury, Kent.*
1898 Gordon, J. G. McH., *Corsemalzie, Whauphill, R.S.O., Wigtownshire.*
1898 Gordon, R. S. G. McH., *Corsemalzie, Whauphill, R.S.O., Wigtownshire.*
1855 Gorham, The Rev. Henry Stephen, F.Z.S., *Highcroft, Great Malvern.*
1874 Goss, Herbert, F.L.S., *The Avenue, Surbiton-hill, Surrey.*
1891 † Green, E. Ernest, Government Entomologist, *Royal Botanic Gardens, Peradeniya, Ceylon.*
1894 Green, J. F., F.Z.S., *West Lodge, Blackheath*, S.E.
1850 Greene, The Rev. Joseph, M.A., *Rostrevor, Clifton, Bristol.*
1898 Greenshields, Alexander, 38, *Blenheim-gardens, Willesden*, N.W.
1899 Greenwood, Edgar, 49, *Melrose-avenue, Willesden Green*, N.W.
1893 † Greenwood, Henry Powys, F.L.S., *Sandhill Lodge, Fordingbridge, Salisbury.*
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1890 † Hall, A. E., *Norbury, Pitsmoor, Sheffield.*
1885 Hall, Thomas William, *Stanhope, The Crescent, Croydon.*
1898 Hamlyn-Harris, R., D.Sc., F.Z.S., F.R.M.S., *Toowoomba Grammar School, Queensland, Australia.*
1891 Hampson, Sir George Francis, Bart., B.A., F.Z.S., 62, *Stanhope-gardens*, S.W.
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1904 Harris, Edward, *St. Conan's, Chingford, Essex.*
1897 † Harrison, Albert, F.L.S., F.C.S., *Delamere, Grove-road, South Woodford, Essex.*
1889 Harrison, John, 7, *Gawber-road, Barnsley.*
1905 Harrison, T. W. H., B.Sc., *The Avenue, Birtley, R.S.O. Durham.*
1881 Henry, George, *Ivy Bank*, 112, *London-road, St. Leonards-on-Sea.*
1903 Herrod, William, *W.B.C. Apiary, Old Bedford-road, Luton, Beds.*
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1876 † Hillman, Thomas Stanton, *Eastgate-street, Lewes.*
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1902 Hole, R. S., Indian Forest Service, c/o Messrs. King, King and Co., *Bombay.*
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1876 † Horniman, Fredk. John, M.P., F.L.S., F.Z.S., &c., c/o *The Librarian, Horniman Museum, Forest Hill*, S.E.
1903 Houghton, J. T., 1, *Portland-place, Worksop.*
1900 Howes, George H., *Box* 180, *Dunedin, New Zealand.*
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1888 Hudson, George Vernon, *The Post Office, Wellington, New Zealand.*
1902 * Hutton, Captain Frederick W., F.R.S., Director of the Canterbury Museum, *Christchurch, New Zealand.*

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1891 Isabell, The Rev. John, *Sunnycroft, St. Sennen, R.S.O., Cornwall.*

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1898 Janson, Oliver J., *Cestria, Claremont-road, Highgate*, N.
1886 Jenner, James Herbert Augustus, 209, *School Hill, Lewes.*
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1886 John, Evan, *Llantrisant, R.S.O., Glamorganshire.*

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1888 Jones, Albert H., Treasurer, *Shrublands, Eltham, Kent.*
1894 † Jordan, Dr. K., *The Museum, Tring.*
1902 Joy, Norman H., M.R.C.S., L.R.C.P., *Bradfield, Reading.*

1884 Kane, W. F. de Vismes, M.A., M.R.I.A., *Drumleaske House, Monaghan.*
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1876 † Kay, John Dunning, *Leeds.*
1896 † Kaye, William James, *Caracas, Ditton Hill, Surbiton.*
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1890 Kenrick, G. H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*
1904 Kershaw, G. Bertram, *Ingleside, West Wickham, Kent.*
1898 Kershaw, J. A., *Morton Banks, Lewisham-road, Windsor, Melbourne, Victoria.*
1901 Kershaw, John C. W., *Macao, China.*
1900 Keys, James H., *Morwell, Freedom-villas, Lipson-road, Plymouth.*
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1905 Kitchen, Vernon Parry, *The Priory, Watford.*
1889 Klapálek, Professor Franz, *Karlín* 263, *Prague, Bohemia.*
1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Hatherlow, Raglan-road, Reigate.*
1876 Kraatz, Dr. G., 28, *Link-strasse, Berlin.*

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1868 Lang, Colonel A. M., R.E., *Box Grove Lodge, Guildford.*
1900 Lang, The Rev. H. C., M.D., *All Saints' Vicarage, Southend-on-Sea.*
1901 Lathy, Percy I., *Penton House, Cheshunt.*
1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*
1899 Lea, Arthur M., Government Entomologist, *Hobart, Tasmania.*
1900 Lefroy, H. Maxwell, B.A., *Muzaffarpur, Behar, Bengal.*
1901 Leigh, George F., *Woodside, off Umbilo-road, Congella*, nr. *Durban, Natal.*
1883 Lemann, Fredk. Charles, *Blackfriars House, Plymouth.*
1898 Lethbridge, Ambrose G., *Nordrach-on-Dee, Banchory, N.B.; Guards Club, Pall Mall*, S.W.
1903 † Levett, The Rev. Thomas Prinsep, *Frenchgate, Richmond, Yorks.*
1898 Lewis, E. J., F.L.S., 4, *Clements Inn*, W.C.
1876 Lewis, George, F.L.S., 87, *Frant-road, Tunbridge Wells.*
1902 Lewis, J. H., *Ophir, Otago, New Zealand.*
1892 Lightfoot, R. M., *Bree-st., Cape Town, Cape of Good Hope.*
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1881 † Lloyd, Alfred, F.C.S., *The Dome, Bognor.*
1885 † Lloyd, Robert Wylie, *St. Cuthberts, Thurleigh-road, Balham,* S.W.
1903 Lofthouse, Thomas Ashton, *The Croft, Linthorpe, Middlesbrough.*
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1899 Lounsbury, Charles P., B.Sc., Government Entomologist, *Cape Town, S. Africa.*
1894 Lowe, The Rev. Frank E., M.A., *St. Stephen's Vicarage, Guernsey.*
1893 Lower, Oswald B., *St. Oswalds, Bartley Crescent, Wayville, South Australia.*
1901 Lower, Rupert S., *Davonport-terrace, Wayville, South Australia.*
1898 Lucas, William John, B.A., 28, *Knight's Park, Kingston-on-Thames.*
1904 Luff, W. A., *La Chaumière, Brock-road, Guernsey.*
1880 Lupton, Henry, *Lyndhurst, North Grange-road, Headingley, Leeds.*
1903 Lyell, G., Junr., *Gisborne, Victoria, Australia.*
1901 Lyman, Henry H., M.A., F.R.G.S., 74, *McTavish-street, Montreal, Canada.*

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1900 Mackwood, The Hon. F. M., M.L.C., *Colombo, Ceylon.*
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1895 Massey, Herbert, *Ivy-Lea, Burnage, Withington, Manchester.*
1865 Mathew, Gervase F., F.L.S., Paymaster-in-chief, R.N., *Lee House, Dovercourt, Harwich.*
1887 Matthews, Coryndon, *Stentaway, Plymstock, Plymouth.*
1899 May, Harry Haden, 12, *Windsor Terrace, Plymouth.*
1904 Meade-Waldo, Geoffrey, *Stonewall Park, Edenbridge, Kent.*
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1887 Merrifield, Frederic, President, 24, *Vernon-terrace, Brighton.*

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1888 Meyer-Darcis, G., c/o Sogin and Meyer, *Wohlen, Switzerland.*
1880 Meyrick, Edward, B.A., F.Z.S., F.R.S., *Thornhanger, Marlborough.*
1894 Miall, Professor Louis Compton, F.R.S., 1, *Richmond Mount, Headingley, Leeds.*
1883 Miles, W. H., *The New Club, Calcutta.*
1905 Mitford, Robt. Sidney, C.B., 35, *Redcliffe Square,* S.W.
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1879 Monteiro, Dr. Antonio Augusto de Carvalho, 70, *Rua do Alecrinar, Lisbon.*
1902 Montgomery, Arthur Meadows, 34, *Shaliman Gardens, Pembridge-road, North Acton,* N.
1853 Moore, Frederic, D.Sc., A.L.S., F.Z.S., 17, *Maple-road, Penge,* S.E.
1899 Moore, Harry, 12, *Lower-road, Rotherhithe.*
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1889 † Morice, The Rev. F. D., M.A., Fellow of Queen's College, Oxford, *Brunswick, Mount Hermon, Woking.*
1895 † Morley, Claude, *The Hill House, Monk's Soham, Suffolk.*
1893 Morton, Kenneth J., 13, *Blackford-road, Edinburgh.*
1900 Moser, Julius, 60, *Bulow-strasse, Berlin.*
1901 † Muir, Frederick, *E. and S. African Telegraph Co., Mozambique.*
1869 † Müller, Albert, F.R.G.S., c/o Herr A. Müller-Mechel, *Grenzacherstrasse,* 60, *Basle, Switzerland.*
1904 Mumford, Frank S., 10, *Mountfield Gardens, Tunbridge Wells.*
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1889 Nevinson, Basil George, M.A., F.Z.S., 3, *Tedworth-square, Chelsea,* S.W.
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1890 Newstead, R., *Johnston Tropical Laboratory, University, Liverpool.*
1900 Nicholl, Mrs. M. De la B., *Merthyr Mawr, Bridgend, Glamorganshire.*
1904 Nicholson, W. A., 36, *Promenade, Portobello, N.B.*
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1893 Nonfried, A. F., *Rakonitz, Bohemia.*
1886 Norris, Herbert E., 15, *Market-place, Cirencester.*
1878 Nottidge, Thomas, *Ashford, Kent.*
1895 Nurse, Major C. G., *Timworth Hall, Bury St. Edmunds.*

1869 Oberthür, Charles, *Rennes (Ille et Vilaine), France.*
1877 Oberthür, René, *Rennes (Ille et Vilaine), France.*
1893 † Ogle, Bertram S., *Steeple Aston, Oxfordshire.*
1893 Oliver, John Baxter, 22, *Ranelagh Villas, Hove, Brighton.*
1873 Olivier, Ernest, *Ramillons, près Moulins (Allier), France.*

1895 Page, Herbert E., *Bertrose, Gellatly-road, St. Catherine's Park,* S.E.

1898 Palliser, H. G., *Holmwood, Addlestone, Surrey.*
1901 * Peal, Henry Woolner, *Indian Museum, Calcutta.*
1883 Péringuey, Louis, *South African Museum, Cape Town, South Africa.*
1903 † Perkins, R. C. L., B.A., Board of Agriculture, Division of Entomology, *Honolulu, Hawaii.*
1879 Perkins, Vincent Robt., *Wotton-under-Edge.*
1900 Philips, The Rev. W. J. Leigh, *The Cottage, Parkwood-road, Tavistock.*
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1885 Poll, J. R. H. Neerwort van de, *Driebergen, Netherlands.*
1870 † Porritt, Geo. T., F.L.S., *Mayfield, Edgerton, Huddersfield.*
1884 † Poulton, Professor Edward B., D.Sc., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford, Vice-President, *Wykeham House, Banbury-road, Oxford.*
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1900 Reid, Percy Charles, *Feering Bury, Kelvedon, Essex.*
1893 Reid, Captain Savile G., late R.E., *The Elms, Yalding, Maidstone.*
1898 Relton, R. H., c/o Perkins and Co., Ltd., *Brisbane, Queensland.*
1890 Rendlesham, The Right Honble. Lord, *Rendlesham Hall, Woodbridge.*
1898 Reuter, Professor Enzio, *Helsingfors, Finland.*
1894 Riding, William Steer, B.A., M.D., *Buckerell Lodge, Honiton.*
1853 Ripon, The Most Honble. the Marquis of, K.G., D.C.L., F.R.S., F.L.S., etc., 9, *Chelsea Embankment*, S.W.
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1902 Sloper, Gerard Orby, *Westrop House, Highworth, Wilts.*
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1895 Smith, W. W., *Ashburton, Canterbury, New Zealand.*
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1898 Stebbing, Henry, 6, *The Chase, Warley Mount, Brentwood, Essex.*
1889 Straton, C. R., F.R.C.S., *West Lodge, Wilton, Salisbury.*
1896 Strickland, T. A. Gerald, *Darlingworth House, Cirencester.*
1900 Studd, E. A. C., *Kerremens, B.C.*
1895 Studd, E. F., M.A., B.C.L., *Oxton, Exeter.*
1903 Swale, Harold, M.B., *Arawa House, Rotorua, New Zealand.*
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1893 Turner, Henry Jerome, 98, *Drakefell-road, St. Catherine's Park, Hatcham*, S.E.
1894 Turner, Thomas, *Cullompton, Devon.*
1886 Tutt, James W., *Rayleigh Villa, Westcombe Hill*, S.E.
1904 Tylecote, Edward F. S., M.A., *Ravensdene, Warwick Park, Tunbridge Wells.*

1893 Urich, Frederick William, *Port of Spain, Trinidad, British West Indies.*

1904 † Vaughan, W., *Cocogalla, Madulsima, Ceylon.*
1866 Verrall, George Henry, *Sussex Lodge, Newmarket.*
1897 Vice, William A., M.B., 19, *Belvoir-street, Leicester.*

1895 Wacher, Sidney, F.R.C.S., *Dane John, Canterbury.*
1901 Waddington, John, *Park Holme, Harehill-avenue, Leeds.*
1899 Wade, Albert, 52, *Frenchwood-street, Preston, Lancashire.*

1897 Wainwright, Colbran J., 45, *Handsworth Wood-road, Handsworth, Birmingham.*

1870 * Walker, The Rev. Francis Augustus, D.D., F.L.S., *Dun Mallard, Cricklewood*, N.W.

1878 Walker, James J., M.A., R.N., F.L.S., Secretary, *Aorangi, Lonsdale-road, Summertown, Oxford.*

1863 † Wallace, Alfred Russel, D.C.L., Oxon., F.R.S., F.L.S., F.Z.S., *Broadstone, Wimborne, Dorset.*

1866 † Walsingham, The Right Honble. Lord, M.A., LL.D., F.R.S., F.L.S., F.Z.S., High Steward of the University of Cambridge, *Merton Hall, Thetford* ; and 66*a*, *Eaton-square*, S.W.

1886 Warren, Wm., M.A., 61, *Wilton-avenue, Chiswick-lane*, W.

1869 Waterhouse, Charles O., *Ingleside, Avenue-gardens, Acton*, W. ; and *British Museum (Natural History), Cromwell-road*, S.W.

1901 Waterhouse, Gustavus A., B.Sc., F.C.S., *Royal Mint, Sydney, New South Wales, Australia.*

1900 Watkins, C. J., *King's Mill House, Painswick, Stroud, Gloucestershire.*

1904 Watson, Rev. W. Beresford, *St. Martin's Vicarage, St. Philip, Barbados, W. Indies.*

1893 Webb, John Cooper, 218, *Upland-road, Dulwich*, S.E.

1876 † Western, E. Young, 36, *Lancaster Gate, Hyde Park*, W.

1886 Wheeler, Francis D., M.A., LL.D., *Paragon House School, Norwich.*

1884 White, William, 75, *Thurlow Park-road, West Dulwich*, S.E.

1903 Wiggins, Clare A., M.R.C.S., *Kisumu, Lake Victoria Nyanza, British East Africa.*

1896 Wileman, A. E., c/o H.B.M.'s Consul, *Kobe, Japan.*

1894 Wilson, Edwin, *Mill-lane, Cambridge.*

1904 Winterscale, J. C., F.Z.S., *Karangari, Kedah*, c/o Messrs. Patterson, Simons and Co., *Penang, Straits Settlement.*

1894 Wolley-Dod, F. H., *Millarville P. O., Alberta, N.W.T., Canada.*

1900 Wood, H., 9, *Church-road, Ashford, Kent.*

1881 Wood, The Rev. Theodore, *The Vicarage, Lyford-road, Wandsworth Common*, S.W.

1905 Woodbridge, Francis Charles, *Northcroft, Cornwall-road, Uxbridge.*

1901 Woodforde, F. C., *Market Drayton.*

1899 Woolley, H. S., 7, *Park-row, Greenwich*, S.E. ; and *P. O. Box* 1047, *Waterbury, Conn., U.S.A.*

1891 Wroughton, R. C., Inspector General of Forests, Indian Forest Service, c/o Army and Navy Co-operative Society, Ltd., 105, *Victoria-street*, S.W.

1888 Yerbury, Colonel John W., late R.A., F.Z.S., *Army and Navy Club, Pall Mall*, S.W.

1892 Youdale, William Henry, F.R.M.S., *Daltonleigh, Cockermouth.*

1904 Young, L. C. H., 10, *Harnam-street, Fort, Bombay.*

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TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1905.

I. *The Life History of* Gerydus chinensis, Felder. By JOHN C. W. KERSHAW, F.L.S., F.E.S.

[Read November 16th, 1904.]

PLATE I.

ALTHOUGH the imago of *Gerydus chinensis* is peculiar, with its very long body and broad, flattened legs, yet its early stages are still more curious. The butterfly is fairly common throughout the year in certain localities near Macao and Hongkong, but it keeps more or less strictly to these shady and usually damp places, and is to a certain extent crepuscular, though it is also on the wing during the day.

It lays its eggs towards evening and till night fairly sets in, on stems and leaves of plants and trees infested with Aphides or Hemiptera and overrun by a host of ants of two species (*Polyrrhachis dives*, Sm., and *Dolichoderus bituberculatus*, Mayr.), both Aphides and ants apparently feeding on juice exuding from the plant. Any vegetation subject to these secretions seems to be attractive to them, the ants not appearing to use the Aphides as ant-cows, though of this I am not quite certain. The Aphides swarm so thickly that the plant-stem or leaf is invisible, and, barring heavy rain, they are as a whole stationary for days together, though slowly changing their positions individually, and going through various transformations, fresh lots continu-

ally replacing the old. The plants they seem specially to affect are various species of bamboo, lichee, *Stillingia sebifera* and a species of bur-marigold, *Bidens pilosa*, represented in the drawing. This latter is a very common plant here, possessing bunches of spiky seeds with branched ends armed with microscopic spines pointing downwards, which catch in every imaginable thing that touches them.

The ♀ butterfly, after almost interminable dancing up and down and wandering hither and thither, finally alights after two or three attempts in the midst of the Aphides and ants, which she thrusts aside with a brushing movement of her tail, immediately laying a single egg. She then generally moves slightly and remains for some time sucking up the exuding juice of the plant; both ♂ and ♀ are very fond of it: half-a-dozen may occasionally be seen close together on one leaf or stem, drinking this sap, thrusting their tongues into any interstices left by the Aphides. The ants do not appear to meddle either with the butterflies or the eggs, though ants are very destructive to eggs of most butterflies, and I have just recently seen two butterflies (a Hesperid and a *Neptis*) seized by the tongue as they probed a flower, and dragged off by this same species of ant. Nor do they seem to interfere with the larvæ. Probably they are too much occupied in drinking the sap to trouble about eggs, etc.

The egg is circular and flat, of a pale green, ringed circumferentially, the edges of the rings milled like a coin. It hatches in four days, the issuing larva being nearly cylindrical at first, not assuming its slug-shape till a later stage. It is light yellow, with a distinct purplish dorsal line, and a few light-coloured hairs chiefly at head and tail, the head dark. Later on it becomes limaciform, yellow or greenish-yellow and banded longitudinally with purple-brown, the segments well-defined, the first segment swollen and produced, so that the head can be withdrawn entirely into it, as it usually is when the larva is resting.

The larvæ feed on the Aphides, sometimes pressing them against the plant with head and forelegs, sometimes holding them in the forelegs quite away from the plant. A few bites disposes of an Aphis, and the larva then licks and cleans its legs, just as a Mantis does. Some Aphides must have a better flavour than others, as the larvæ pick and choose, moving their heads up and down over the backs of the insects, evidently smelling them. As a rule

the creatures seem to make little attempt to escape till they are actually bitten, when struggling is useless. When not engaged in feeding, the larvæ rest amongst the Aphides or crawl leisurely about between or over them, and the Aphides do likewise, the larvæ being sometimes covered with them. The eggs of the butterfly, too, are often hidden under a mass of Aphides.

When nearly full-grown the larvæ lose most of their sparse hairs and their colours fade, and the bands and four blotches on the seventh and eighth segments become less distinct. When about to pupate they walk about at quite a fair rate of speed, and having chosen a spot, spin a few threads a little distance from head and tail. My larvæ pupated on a piece of bark, one putting a band round its middle and pupating horizontally, the other vertically and without a band, though both had the threads (not connected to the pupæ) at head and tail. The tail of the pupa is cut off squarely, forming a disc, thus securing a good hold, probably sufficient without the band round the middle. It seems to be affixed with some secretion, not actual threads. There is a small process each side of the third segment from the tail. The pupal state lasts about ten days. Both larvæ and pupæ strike one as being small compared with the size of the butterfly. I have only found the larvæ feed on two species of Aphis, but they doubtless eat other kinds. One was slate-coloured with white efflorescence, the other greenish with four dark-green patches, some of them being fringed with white, probably moulted skin.

If the butterflies were only numerous enough they would certainly prove a blessing to the gardener, for many trees here, especially the lichee (a fruit tree) suffer very much from "bugs" of all sorts which, even when they do not entirely eat away the leaves, seem to blight them or cause them to shrivel up. The larval state lasts about fifteen days, and I reckoned on the average, from first to last, the larva would eat some twenty Aphides per day, but it would require many larvæ to make much impression on the crowds of Aphides one sees; perhaps a yard of bamboo stem two or three inches in diameter being absolutely covered with these disgusting insects.

I am not sure, but have some reason to think that the larvæ tend to assimilate in colour to the Aphides they happen to be feeding on. At first, as the eggs were laid

amongst the green Aphides, I fed the larvæ thereon, but a typhoon having washed away the food supply, I could only find the slate-coloured species, which, however, the larvæ seemed to enjoy quite as much. But I noticed soon after that the colours faded and the purple-brown tended to mingle with the yellow. This is a question it will be interesting to decide. One of the features of this curious life history is the calm way in which the larva moves amongst the Aphides and selects his prey, and the indifference with which the latter apparently accepts his fate.

I have since found swarms of a bright yellow Aphis on some Asclepias plants, on which I hope to rear some larvæ, with the object of testing their adaptability of colour to their surroundings. *Gerydus chinensis* lays at intervals all through the year, but these eggs were taken in July and August.

Explanation of Plate I.

Life History of *Gerydus chinensis*, Felder.

Butterfly laying egg amongst Aphides.

Fig. 1. Egg, enlarged.
2. Larva just hatched, enlarged.
3. ,, nearly full-grown, natural size.
4. Pupæ, natural size.
5. Larva eating Aphis, enlarged.
6. Aphides, two species, enlarged.

II. *Butterfly-destroyers in Southern China.* By John C. W. Kershaw, F.L.S., F.E.S.

[Read November 16th, 1904.]

Perhaps the creatures which in this district destroy or injure the largest number of butterfly imagines are lizards, particularly one species (*Calotes versicolor*, Daud.), which climbs up into the clumps of *Lantana camera*, a profusely flowering plant or shrub which grows here on most waste ground. Probably the greater part of their prey consists of *Hesperiidæ*, three or four species of which haunt the flowers of the *Lantana* in immense numbers. Other reptile foes to butterflies are probably the tree-frogs, and possibly the very numerous small snakes which are always climbing in the tops of the bushes.

Spiders' webs account for some mishaps to butterflies, but they are not invariably eaten; at other times species which are reckoned most distasteful as food of other animals are seized and eaten at once, according, I suppose, as the owner of the web is hungry or otherwise. I have seen our large black-and-yellow spider (*Epeira maculata* of Donovan's "Insects of China") eating *Euplœa amymone*, Godt., caught in his web. He had attacked and considerably injured the lower side of the abdomen and part of the thorax; but when I took the butterfly from him, examining it laid flat in my hand, the insect suddenly flew up to the top of a large banyan tree, where it settled. One would hardly imagine even a *Euplœa* would have much life in it after being so badly mauled. The same spider I have seen eating *Papilio dissimilis*, L. (=*clytia*, L., =*panope*, L.), the black-and-yellow form. Also at different times *Neptis eurynome*, L., and *Euplœa midamus*, L., but on the whole it is not common to see a butterfly in a spider's web. I might mention that I saw this spider devouring a small bat, about eight inches across the wings, caught overnight in his web.

There is also here a small but thickset white spider which usually conceals itself in white flowers, and which

I have two or three times seen capture the little black-and-yellow Skipper, *Telicota bambusæ*, Moore, by the head.

The large green Mantis, *Hierodula saussureii*, W. F. Kirby, our commonest species, apparently catches anything he can get hold of. I have kept Mantidæ and fed them with many species of butterflies, none of which they refused, but data obtained from creatures in captivity are not, I think, very reliable, as under these circumstances they often take food which in a natural state they would probably reject. But I have seen this Mantis in the open on a shrub, eating the two species of *Euplœa* before mentioned. He is a very bold insect, and, even in a wild state, seldom refuses any butterfly offered to him.

One of the worst enemies of the *Hesperiidæ* is a large hairy species of (Asilid ?) fly, which seizes them and drives its proboscis into the thorax. Either it is very fearless or it cannot easily disengage its weapon from its prey, for I have often kept stirring one up with a stick, when it would merely fly to another leaf close by, still holding its victim. These flies also kill a moderate-sized Cicada in great numbers.

In the last two months (August and September) I have three times seen butterflies seized by the tongue by ants, as they probed a flower. On one occasion an ant seized *Neptis eurynome* by the tip of the tongue, and the butterfly immediately flew away with the ant hanging on it. About half-an-hour afterwards I captured the *Neptis* with the ant still clinging to its tongue. The other instances were both *Telicota bambusæ*, and each was caught by the tip of the tongue by an ant.

I should be inclined to think that the birds here account for very few imagines, comparatively speaking, whatever they may do in the larva and pupa line. The only birds I have seen attack butterflies, and generally miss them, are sparrows (our common sparrow is *Passer montanus*), the green Bulbul, *Pycnonotus sinensis*, the black Drongo, *Buchanga atra* and the Paradise-flycatcher, *Terpsiphone princeps*. During five years I have, perhaps, seen a dozen attacks on butterflies by birds, and only seen them captured two or three times. Speaking from my own limited experience I should say imagines here have few enemies, and that those few inflict very slight damage. Unfavourable climatic conditions seem to be most inimical to them. (*Cf.* Trans. Ent. Soc. 1895, pp. 437–8.)

But in the egg, larva and pupa state, butterflies here have a host of enemies, the eggs especially being destroyed by ants, which also attack and carry off young larvæ and pupæ. Ants almost certainly account for the greater part of casualties amongst eggs, because of their being ubiquitous and in countless swarms. One small orange plant, which I often examined many consecutive mornings, was much frequented by ♀♀ of *Papilio polytes*, L., and *P. helenus*, L., also *P. sarpedon*, L. I have frequently seen the ♀ lay an egg and fly off, and a moment after an ant, waiting below the leaf, would carry the egg away. Sometimes I have noticed a particular leaf and stem with three or four eggs close together on them, and returning an hour or so later have found them gone, almost certainly taken by the ants which were invariably climbing over the plant.

Centipedes kill pupæ, twining round them, boring a tiny hole, and appearing to suck out the contents.

Some of the Hemiptera or "bugs" (*Capsidæ*, I think) probably account for the destruction of some pupæ, as I have seen one with its trunk driven into a chrysalis, and two or three times have seen a small red-and-black bug, about an inch long, force its proboscis through the thin shell of a small snail and eat or suck out the inmate.

Amongst birds the Cuckoos especially must destroy very great numbers of butterfly larvæ during their short summer stay here, *Cuculus micropterus* probably inflicting most damage. The Cuckoo, like the Mantis, will eat almost anything, and if a larva is particularly hairy it rubs it up and down on the ground or tree trunk till it breaks off most of the hair. It seems very fond of the larvæ of *Rhopalocampta benjamini*, Guer., a bright yellow-and-black larva with a red head, and during May and June its stomach generally contains several, judging from those shot. Wasps, of course, carry off many larvæ, but chiefly, I think, those of the *Pieridæ*, which are usually fairly smooth-skinned. I was rearing a lot of *Catopsilia pyranthe* larvæ on the roof of the house, on a *Cassia* plant, and the wasps carried off so many I was obliged to cover them up. The ants, too, killed many of the newly-hatched larvæ, and as soon as pupating began, started carrying off the pupæ.

Ichneumonidæ I pass over, all kinds of larvæ in all parts of the world being presumably attacked by them, but some of the *Pieridæ* here seem especially subject to

their attacks. Of about a score pupæ of *Delias aglaia*, L., found on a shrub, three produced butterflies, the rest ichneumons. Of the same number of young larvæ reared, all fed well till about half-grown, then all but six dwindled away to mummies, two died when full-grown; the rest pupated, but only two butterflies appeared, the other pupæ shrivelling up. They were supplied with fresh food every day, and till half-grown appeared very healthy. There seem to be special checks on the increase of some species of *Pieridæ*.

No doubt the injuries done to the wings of butterflies are often the result of attacks by various enemies, but I think the greater part are caused by the insects themselves flying through thick cover, where one may often distinctly hear and see the wings of a *Papilio* strike leaves and twigs; or by getting into and escaping from the numerous spiders' webs, and threads stretched from tree to tree; or by simple stress of weather. Several times I have seen what I took, at first sight, to be a new species of *Papilio* which when taken proved to be either *P. polytes* or *P. dissimilis* with the hind-wings covered with the red or yellow pollen of flowers, generally the large flowering tree *Bombax ceiba*. These specimens invariably had the wings torn, and as the pollen is sticky it probably was partly the cause of various rents and ragged margins.

One often sees a *Papilio*, generally either *P. agamemnon*, L., or *P. sarpedon*, which haunts a certain locality or "beat" for days together, flying at a good height and seldom settling; these "solitaries" chase away other butterflies and even dragon-flies, and I have seen *Euplœinæ* and *Neptis* chase dragon-flies, which swarm here. Of all insect foes I should have thought that dragon-flies, from their very swift flight and powerful jaws, would have been most dangerous to butterflies, but I have never seen one attack a butterfly, though they sometimes kill and eat each other.

My few notes would, in short, point to butterflies which have escaped the sundry and manifold dangers of the egg, larva and pupa stages having collectively, comparatively little to fear in the perfect state.

III. *On* Erebia palarica,* n. sp., *and* Erebia stygne; *chiefly in regard to its association with* E. evias, *in Spain.* By Dr. Thomas A. Chapman, M.D.

[Read December 7th, 1904.]

Plates II, III, IV, V, VI.

In 1902 I reported that *E. stygne*, Ochs., had not been recorded as occurring in Spain. In this I am not quite sure that I was not correct, but at any rate, if not recorded, the Entomologists of Madrid were certainly aware that the species occurred in the Sierra Guadarrama, as they have specimens in their collections, and have it noted in their MS. lists. I am not aware that even now any Spanish localities are known beyond this one, except these recorded in our Proceedings by Mrs. Nicholl and myself.

In 1902 and 1903 I met with forms of *E. stygne* in Spain, that led me to make sundry observations on that species to the Society, in connection with specimens exhibited. Mrs. Nicholl also met with the species in 1902, and also Prof. Poulton, and I was able to make some remarks on their specimens which were exhibited at our meetings. Amongst the general remarks I hazarded, I expressed the opinion that *Erebia stygne* in Spain was well worthy of further observation, and study. My observations during 1904 have, I think, fully confirmed the soundness of this opinion, but though adding something to our knowledge, they leave the necessity for further research in regard to the species and those allied to it, at least as cogent as before.

It may perhaps be well, before relating last season's

* *Palarica*, from habitat, Pajares. Pajares is said to mean a place with much fodder and litter, as if *Paleares* = *cum multas paleas;* a bad (and I am not sure that this is a bad) excuse for getting rid of the j, is better than none, as the Spanish j = Scotch ch, is shibboleth to the South Briton ; Spanish j is often = Latin l, *e.g.* mejor—melior. I should have liked to have given the name *nicholli*, in honour of Mrs. Nicholl, who first took the species two years ago, but this would lead to confusion with *Erebia glacialis*, var. *nicholli*, Oberth.

experience, to recapitulate our previous knowledge of *E. stygne* as a Spanish species.

I found in 1902 a very large and brightly-coloured race of *stygne* at Bejar, which I named *bejarensis*,* and exhibited to the Society on Nov. 5th. At the same meeting † Mrs. Nicholl exhibited a large and small form of *stygne* from the Picos de Europa. Of the large form which is no doubt identical with *palarica*, there were only two poor specimens, and all the evidence went to show they were a form of *stygne*, but coming from the same locality as a small form, it added an important item of interest to the species.

In the following year, I took at Canales de la Sierra a fairly large form of *stygne*, associated mimetically with a small form of *E. evias*, nearly, if not absolutely identical with Zapater's *evias*, var. *hispanica*, so I gave the same varietal name to the form of *stygne*. These facts are reported in the Proc. Ent. Soc. 1903, pp. xlv *et seq.*

Still later the President enabled me to show the Society (Proc. 1904, p. xlvi) two Erebias from the Guadarrama, which confirmed the existence of *stygne* there, and also showed that it was there accompanied by a specially modified form of *E. evias*.

It further happens that *E. evias* accompanied the small *stygne* taken by Mrs. Nicholl at the Picos, though this had not been recorded when I examined the specimens with a view to the present report.

All the forms of *stygne* so far known from Spain therefore seemed to be no doubt varieties of that species, some of them modified to agree with *E. evias*. There was nothing in any of the forms that did not appear to be well within the limits of variation.

Mrs. Nicholl has an interesting note on the *stygne* of the Picos in Ent. Record, vol. xvi, p. 48. I may quote some items of this, as I cannot find any details of Mrs. Nicholl's observations on the Picos Erebias in the Society's Transactions.

July 10th. "Encamped at a height of nearly 5000 ft. on the southern face of the chain, and found the mountain pastures just above this level, swarming with *E. stygne*. Both sexes were out and in good order, though some of the males were slightly worn. I caught a good many and kept a few; they were quite typical specimens, per-

* Proc. Ent. Soc. 1902, p. xxxvi. † l. c., p. xxxv.

haps a trifle larger than those from Dauphiné and the Pyrenees."

On the 19th, "*stygne* was nearly over." Mrs. Nicholl tells me that she also took *evias* ("mostly worn, rather large type, and high up, none low down").* I have already noted two specimens of *evias* are mixed with the *stygne* (no doubt some of the few noted above) from the Picos in the drawers at South Kensington. I incline to think they were *not* so mixed by Mrs. Nicholl, but, whoever did so, afforded a proof that the high-level July *evias* from the Picos does, in some of its specimens at least, closely resemble the *stygne* of the same time and place. The note in the "Record" proceeds: "On July 22nd, at a height of 3000 to 3500 ft. I saw several large Erebias, quite fresh out. I caught six or seven specimens, all males, and considered them to be *E. æthiops* and therefore only kept a couple, . . . they turned out to be very large specimens of *E. stygne*." These two specimens are *E. palarica*. Both specimens are, however, poor, the one in the British Museum, the best, is very far from fresh, so that the difference of date between *E. palarica* and *E. stygne* is less than Mrs. Nicholl's note implies. They are no doubt on the wing at the same time at the Picos, as I found them this year at Pajares. I must take my share of responsibility for declaring these specimens of *palarica* to have been *stygne*. They were very much the same size as my *E. stygne*, var. *bejarensis*,† with which I was then busy. So that their large size did not suggest specific difference, whilst the genitalia of the specimen I examined, though not quite typical *stygne*, were within the limits of variation found in these appendages in other species of the genus. With the small amount of material available the conclusion seemed clear that it must be regarded as a var. of *stygne*, possibly near var. *bejarensis*, both being very large, but certainly requiring further investigation.

We now come to my observations of the present year (1904). From July 8th to July 22nd, Mr. Champion and I stayed at Puerto de Pajares, which is the pass across the Cantabrian Mountains followed by both the road and the railway from Leon to Gijon, at an elevation of about 4500 ft., and at several places in the neighbourhood we

* See Notes on *evias* later.

† (The specimen in B. Mus. is 56 mm.; small for *palarica*, a maximum for *bejarensis*.)

found a large and a small form of *stygne*, which, there can be little doubt, with probably some trifling local variations, are the same two forms as those taken by Mrs. Nicholl at the Picos de Europa. In one respect our observations, though confirming Mrs. Nicholl's, show that the apparent conclusion to which they pointed is incorrect. Mrs. Nicholl found one form at a high, and the other at a low level, and the deduction was, that it was the habit of the two forms to be separated by being adapted to living at different elevations, even if the lower one were not a second brood possible at the warmer station.

Well, we found one form at a low, and the other at a high level, but then again we found precisely the contrary case, in fact we found both forms at all levels from about 4000 ft. to over 6000 ft. The small form maintains its characters both at a high and low level, as does also the large one.

We found, however, that each species had definite localities, within which the other did not occur, and in the case of two such localities for the small species, and also of two for the large, the localities seemed to be very definitely circumscribed. The species were found in other places in which also the habitats may have been as definitely marked out, but it did not happen that our examination of them was sufficiently minute to justify an opinion. Indeed, of those I regarded as well defined, this is of course only true in regard to certain directions, but these directions were sufficiently numerous, being in fact the directions from which we turned back when collecting them, because no more were to be seen, to justify the broad statement.

I must go into a little more detail as to the reasons that led me to consider the large form *palarica*, to be a distinct species from the small one, which I regard as a local form of *stygne* very close to my var. *hispanica*.

The first and obvious reason is the difference in size. Size one regards usually as of little value as a specific character, and if it were in this case to stand alone, I should, as I did in the case of var. *bejarensis*, attach no importance to it. The size is, nevertheless, in this case a very marked and unmistakable character. I have measured all the specimens I brought home, and the result of measuring 55 ♂ 11 ♀ of *stygne* from Pajares, and 115 ♂ and 37 ♀ of *palarica* is, that the most dwarf *palarica* is 1 mm. larger than the most giant *stygne* (*hispanica*), and

that the mean expanse of the two species differs by no less than 11 mm., nearly half-an-inch. The smallest ♀ ranging in size very close to *stygne*, var. *hispanica*, has a facies quite characteristic of *palarica*, so that no one could confuse them together.

Palarica is indeed the largest of all the Erebias, averaging 59·0 mm. in expanse, and ranging from 55 mm. to 64 mm.

The largest *Erebia* according to Ruhl is *parmenio*, to which he gives an expanse of 50 mm. to 55 mm. *E. cyclopius* is as large, and *embla* very nearly so. I find, however, that *evias* goes to 54. mm., but this is a maximum. *Palarica* has 59 mm. as an average.

In size, *stygne*, at Pajares, and *palarica* do not overlap; the largest of the one is smaller than the smallest of the other.

The next point is that each was, wherever we closely observed it, strictly confined to its own habitat, into which the other did not trespass; this was very remarkable at two points where the areas occupied by each approached to within a few dozen yards of each other. At one of these places opportunity served for me to notice how sharply defined was the margin of the territory of each species, and how a specimen driven over the border, came back after a very short detour. Nor did I ever find one butterfly where I found the other though it might not be very far off.

Still it is difficult to suppose, considering how common they were in places, each in its own area, and how close these areas often were, that specimens did not sometimes visit the habitats of the other species, though I did not meet with such a case. And if they did and they were really all one species some crossing was to be expected, and intermediate forms ought to have occurred. Yet I must have seen many hundreds of specimens altogether of both species. In most places there was some difficulty in taking specimens, and sometimes only two or three were taken out of a score seen, and of these taken, though many wretched specimens were retained, a large number in poor condition were discarded. Those brought home must therefore be but a portion of the number of individuals from which I draw conclusions. Yet there never was the slightest difficulty in saying at once, of which species any particular specimen was. There was no trace of intermediate or transitional forms or of hybrids. Considering how

easy, even inevitable, crossing must have been, had they been merely forms of one species, I see no means of avoiding the conclusion that the two forms are asyngamic. Such an attitude towards each other, seemed to be regarded as the truest test of specific distinctiveness of two forms, when the subject of "what is a species" was debated at our meeting last Spring. The difficulty is to put it to experiment. In the case of *Erebia palarica* nature has provided the experiment, and the answer is distinct. Usually she separates the subjects of experiments so widely by time, place, and season, that the answer we have to form is a purely personal one, viz. *I think* if the experiment were made the answer would be so and so. It was in this way that I concluded, and still hold that all the Spanish forms of *stygne* previously known to me are of one species.

When we examine the insects themselves for confirmation of this conclusion, we first have size, usually a poor specific character, but here so marked and constant as to have some weight. Then as to markings, the rusty blotches in both species are divided into sections by the more or less dark lines of the nervures, and each section in the interneural spaces of the fore-wing has a definite form that differs completely in the two species, and is constant in every one of the large number I have examined. In *stygne* the interneural blotch on its basal margin is stretched out centrally into a more or less full convex margin, as if the nervures carried the dark ground-colour into the blotch, and so forced it to swell out into the intervals. In *palarica*, each interneural blotch falls away from the base in its mid-neural line, forming a more or less deep notch. This is most marked in the blotch between nerves 3 and 4, where the ocellus is weak or absent. This blotch is also shorter than the others as if it failed with the ocellus, whilst in *stygne*, though the ocellus may be wanting, this blotch stretches inwards at least as strongly as the others. The result is an hour-glass shape of the rusty mark on the fore-wings, contrasting with the characteristic outline in *stygne*. In the ♀ the rusty blotch is continued up to the costa, with a deflection basewards, by a whitish-grey shade, of which any trace is wanting in *stygne*. The blotches on the hind-wings have a similar character. The blotch of each ocellus is much the same in both species when it is reduced, but when it is pronounced and large, it differs

markedly in the two species. In *stygne* it extends basally in a rounded or even pointed projection in the middle of the interneural space, leaving the nervures, pronounced as sharp angular interruptions. In *palarica* the blotches extend inwards rather along the nervures than centrally, and the ocelli never bear the aspect of being at the outer end of the blotch as they so often have in *stygne*. *Palarica* never follows *stygne* in this character of the hind-wing, but a few *stygne* have a little of the tendency of *palarica*.

I have one specimen, and one only of *E. stygne* ♀, that so far traverses some of these distinctive points, that it may really be a hybrid. It is small like *stygne*, but has the inner margin of the blotches of the hind-wings like *palarica*. The blotches of the fore-wings are not distinctive, but the large double apical ocellus is placed in the blotch very much as in *palarica*. In *stygne* these ocelli are usually nearer the outer than inner margin of the blotch, in *palarica* they are quite median.

To resume the distinctive characters of *palarica* and *stygne*, the under-side shows some slight differences. In both, the under-side of the hind-wing in the ♂ is often smooth, black and polished, with little or no marking, this is in fact the rule in *stygne*, and it is often difficult to make out the central darker band, and when seen it appears to have rather a smooth margin. This form is rare in *palarica* and generally the central band is quite conspicuous, and in a few instances has some white markings just outside its outer border. This border is always carried outwards in the interneural spaces, and the general facies is much more that of *evias* than of *stygne*. The markings are usually very distinct, with *stygne* one cannot find a specimen marked enough to make a satisfactory comparison. The ♀ *palarica* under-side differs from that of *stygne*, var. *hispanica*, in being less brown, more grey, and in being more distinctly marked, the basal margin of the central band being obscure or wanting in most *stygne*. There is, however, much variation in both species. If the difference be noted as a slight resemblance in the facies of the under-side of the hind-wings to *evias*, wanting in *stygne*, then we find that var. *peñalaræ* of *stygne* goes nearly as far in this direction as *palarica*, and var. *bejarensis* goes much further.

A distinctive character is the structure of the clasps of

the male appendages. If there were no other reason to separate *palarica* from *stygne* than the outline of the clasps, I should certainly say they were not distinct. Still there is a difference by which *palarica* differs from all forms of *stygne* I have examined, and in which *bejarensis* is distinctly *stygne* and not *palarica*. The difference is slight and difficult to seize, but in some specimens all mounted in the same way, and at the same time,* of *palarica*, and of Pajares *stygne*, the difference is constant. In specimens otherwise mounted it would probably express itself differently. In these preparations, the head of the clasp in *stygne* expands gradually from the neck, and is therefore long and not very broad; the back of the clasp is in one continuous curve, and there is a distinct notch or step at the back of the head. In *palarica* the neck is narrower and continues narrow, and the back of the clasp being, for some distance above the neck to the end, straight and having no notch at the end, the head instead of having nearly parallel sides, and so of quadrilateral form as in *stygne*, has the front line at a considerable angle to the back, and the head looks somewhat triangular. The terminal serrations are less visible in *palarica*, being forced under one edge, instead of being marginal. This shows that the differences are due in some degree to a different amount of twisting in mounting, caused by a difference in form, not necessarily, however, that presented in the preparations.

The form of *stygne* with the nearest approach of clasp form to that of *palarica* is var. *pyrenaica*, but it is distinctly *stygne* and not *palarica*.

In *palarica* the side processes of the tegumen are constantly though slightly longer than in *stygne*. Notwithstanding the relative sizes of the insects, the clasps of *stygne* and of *palarica* are of almost identical size, that of *stygne*, var. *bejarensis*, being longer.

This is decidedly another character making *bejarensis* a variety of *stygne*, and *palarica* distinct. Contrary to what perhaps one would expect, when geographical forms differ in size, the size of the clasps differs also; this is very marked in *æthiops* where the large continental form has a clasp large in proportion compared with the British form.

* By dividing the chitinous ring in the central line between the clasps, and opening it out on the slide, so that the two clasps are at each end of the preparation.

So if *palarica* were a variety of *stygne*, one would expect to find the clasp large proportionally, instead of, as it is, just the same size. The ♀ appendages also differ a little, especially a hemispherical hollow is rugose in *palarica*, much smoother in *stygne*; but I know so little of these appendages, not even the names of the several parts, that I can give no opinion as to the value of the difference, nor have I examined examples enough to know whether they are constant.

Palarica being thus differentiated from *stygne*, one for the moment forgets the many points of resemblance, especially the close resemblance of the appendages, and the general scheme of colour and markings. In both these respects even, it is, however, more distinct from *stygne* than *euryale* is from *ligea*, or *nerine* is from *melas* (not *lefebvrei*, which is a very different thing). Are all the other Spanish forms of *stygne*, *stygne*, or are any of them *palarica*? When in the field I thought that *palarica* was possibly an extreme form of *bejarensis* trusting merely to memory, the two points of large size, and dissociation from *evias* in which they agreed carried too much weight. A mere glance at the specimens when together is enough to show that *bejarensis* and all the others are *stygne*, *bejarensis* is certainly extreme, but *peñalaræ*, though differing in some directions, is fairly intermediate between *bejarensis* and *hispanica*.

I am not sure that I have not too much laboured the distinctions between *palarica* and *stygne*, as it would not surprise me to find that a majority of Rhopalocerists, looking at the specimens in my boxes, where the constancy of the two forms in good series is so manifest, and their facies so different, would off-hand say they are unquestionably distinct.

The small *stygne* of the Puerto de Pajares is intermediate between what I take to be typical *stygne* and the var. *hispanica*. I do not think it enough removed from either to require a varietal name, though it is a fine, large, bright form, and is rather *hispanica* if a name be necessary.

The keynote of *E. stygne*, var. *hispanica*, was its approximation in size and markings to a form of *evias* that met it half-way in this respect, and that flew along with it. I believe Mrs. Nicholl's specimens in the B. M. show that *stygne* and *evias* are similarly associated at the Picos de Europa, they ought therefore to be similarly associated at

Pajares. Probably they are. I took one ♂ specimen of *evias* at Pajares; it was a form that might very well be associated with *stygne*, but as a matter of fact I took it some 200 yards from the nearest *stygne* ground, at about 5000 ft., and I took but the one. Why? it was not in fine condition but not so bad as to show that the species was over.

I also took one ♀ specimen of *evias* at a long distance from the ♂ specimen. It was associated with small *stygne* at the highest point at which I found them, a small colony at 6000 ft. on very steep impracticable rocks, so that I only took two specimens. *Evias* may have been in greater proportion to the *stygne* here as I found one *evias* to two *stygne*, but the whole colony was a very small one, as, though I could not traverse the rocky slope, I easily got round it except at one side where it ended in a precipice. This ground was about 50 ft. above the upper margin of one of the highest localities for *palarica*.

Why was *evias* so rare? Was this a bad season for high-level *evias*? I will explain immediately what I mean by *high-level evias*. It was not for want of going over plenty of ground that I found only these two.

On going rather later (July 24th) to the Guadarrama, we hunted well the slopes of the Peñalara, whence our President brought one specimen each (taken in 1902) of *stygne* and *evias*, taken together, and so alike as to leave no doubt they were mimetically associated on the Peñalara as we found them on the Sierra de la Damanda at Canales. On the Peñalara we found *E. stygne*, var. *peñalaræ*, in considerable numbers, unfortunately in a very poor condition, except on some very rough ground near the top, where they were less common and almost impossible to take. As I brought home some 30 specimens I must have handled 50 or 60 specimens. Amongst them was not even one *evias*. I can only suppose *evias* was for some reason very scarce. We were not too late to have seen some old worn specimens, and I specially took many worn individuals in hopes they might afford an *evias*; they were all, however, *stygne*.

In what I have just said about *evias*, var. *peñalaræ*, some one may perhaps think I am casting some doubt on the President's specimen, that he got it somehow mixed up. If I thought so, I should say so, and no one who knows the President would think such a thing likely. But the

specimen itself is abundant reply to all such doubts, it is just such an *evias* as one would expect to find on Peñalara with *stygne* and is not precisely like any other race of *evias*. Why did I get none? Why did I get only two at Pajares? I incline to believe that *evias* was scarce this season, but I don't know. This brings us to another point which concerns *evias*, which I cannot do more than open up, my own observations being too few to settle anything.

It is this, we have found at three or four places in Spain, a small form of *evias* associated with *stygne*, at a fairly high level, and in each place the two species have a special similar facies. This form occurs about mid-July. But at the end of May there occurs apparently over a large part of Spain, a low-level *evias*. I have never taken this form, being always too late for it on my visits to Spain. But I saw a number this year in collections at Madrid. Like the high-level form, it very probably varies a good deal at different stations, but those I saw at Madrid were large and brightly coloured, like large Swiss specimens, such as I have taken at Locarno, with the rusty marks bright and ruddy, and not yellowish, as in var. *hispanica*, and probably four or five mm. more in expanse than that var. and five or six more than var. *peñalaræ*. Sr. Zapater records both forms from the Teruel district, and Mrs. Nicholl has reported low-level *evias* from various localities, and there are other records. What is the relation of these high- and low-level forms of *evias* to each other? The low are large, bright, early, and self-dependent; the higher, smaller, yellower, later, and associated with *stygne*. Are they syngamic? With only our present light on the matter, I incline to answer "yes," but with hesitation; we have no experiment naturally provided as in the case of *E. stygne* and *palarica*.

I can only repeat that *E. stygne* and *E. evias* in Spain still present many interesting questions for investigation.

High- and low-level *evias* are to a great extent *evias hispanica* and *evias evias*, but I do not think we have evidence to justify such an identification. In fact, Mrs. Nicholl takes *evias evias* at high levels, and *evias hispanica* in Albarracin is not decidedly a high-level form.

Appended is a table of the wing expanse of the varieties of *stygne* and *evias* I have met with, and of *palarica*—in some instances founded on too few specimens to be trustworthy, still the best I can obtain for comparison.

I must note that most of my measurements were made from the insects as set, and are probably two or three mm. too small. I notice that Ruhl's measurements quoted seem small, and I suspect were made in the same way (from tip to tip) in insects with the wings much advanced and therefore in some cases quite five mm. too small.

I add also a note of the varieties of the three species known to me from Spain.

I was successful in getting both *E. stygne* and *palarica* to lay eggs freely by sleeving them over grass.

Unfortunately, being on the move prevented my making such notes of the eggs and young larvæ as I should have liked. I sent a number of eggs to Mr. H. Powell, of Hyères, whose knowledge of Satyrid larvæ is more extensive than that of any other of my entomological friends. I append his notes and my own. The difference between the eggs struck me at first as being considerable, the one have the minute dots that form the coloured patches in few and large groups, the other in smaller but more numerous ones: this conclusion was reached on the first eggs laid by each species, and were those of one female of each. Later when I got eggs laid by several others, I found that these differences were not specific but individual. Each female laid eggs all alike in these markings, and differing more or less from those laid by others, but each species seemed to have practically an identical range of variation in this respect.

Mr. Powell agrees with me in two points. First, the eggs of the larger species are rather the smaller, and, secondly, there would be no difficulty in separating the newly hatched larvæ of the two species if mixed. Curiously, however, Mr. Powell says that the larva of *palarica* is darker than that of *stygne* (though he says that within the egg it is lighter), whilst I note the pale lateral stripes as being rather paler. I agree with him, however, in the stripes being better marked.

I agree with him also in another point that is probably of considerable importance. I supplied both larvæ with a grass (*Festuca ovina*, or something like it) from *stygne* ground, and *stygne* did well on it, and when (at La Granja) I had to find a substitute (I fancy another var. of the same grass), they ate that also, and I succeeded in bringing them home, and believe I have some alive now (Dec. 1904). The *palarica*, however, did badly on the

same grass, and at La Granja, gradually starved themselves, and died. I got none home alive This clearly indicates a different taste in food-plant, as Mr. Powell also points out, though he was handicapped by a Riviera summer, practically making grass unobtainable.

Small *stygne* eggs laid July 14th and 15th, are pearly white when newly laid, but soon become slightly brownish. This is due to a general change of colour, but chiefly to a development of brown patches, each consisting of an agglomeration of dark dots. These vary very much in their disposition. In one or two cases the dots are nearly uniformly distributed (not in patches). The patches may be four or five in the length or width of the egg, with small spaces between, or they may be much smaller, so that there are eight or ten to the length of the egg. On some the dots are distinctly in regular rows in each patch.

They vary a little in size and shape, about 1·3 mm. high, and 0·8 wide, a little narrower at the top, but maintaining width to close to each end. There are 22 ribs, varying from 20 (one counted) to 24 or perhaps 25. The ribs are high but not sharp, and may be a little waved. They never branch or anastomose, but end at top by merging in an area that looks beaded (high power not available). The secondary ribs are poorly marked but very distinct when a suitable light falls on them.

Large *stygne* (*palarica*) eggs laid July 16th and 17th, same as small. They are perhaps those of one ♀ only, but they are very uniform in size of red-brown patches, viz., about 5 or 6 across egg and ribs seem most usually 24, but one is found with 21.

In the individual variations of the eggs it is difficult to be sure of size, but that of *palarica* seems to be fractionally less than of *stygne*—1·2 instead of 1·3 mm. Each ♀ seems to lay eggs of a similar facies, with the later smaller and even stunted and deformed. Later layings by other ♀♀ of *palarica* showed the range of variation in the egg markings to be practically the same in both species.

The eggs of both hatched between July 31st and August 2nd. The young larvæ are very nearly identical. The large *palarica* seem the paler in having the dorsal band slightly narrower and the lateral line is lighter in colour. It might be called white in the larger (*palarica*), yellow in the small (*stygne*), but this would exaggerate the difference.

The following description was taken some time after returning home; it may have some value as a description of first stage of *stygne*, but *palarica* having all died, it is useless for comparison with that species, still less, of course, will the later stages have the value hoped for when I thought I might rear both species.

Erebia stygne (small form), Aug. 24th. Larva full-grown in first stage, length 4·8 mm., head looks very small, about 0·5 mm. wide, forward segments being quite 0·9. It tapers very steadily from 2nd or 3rd abdominal to tail, 9th abdominal segment being about 0·5 mm. across, 10th smaller.

Ground-colour whitish *terra-cotta*, a narrow dorsal red-brown band (or line) broadest at 5th or 6th abdominal. Then a broad pale band, which includes both I. and II., which are widely apart, one at front, other at hind-margin of segment, and II. quite twice as far from middle line as I. Next, a narrow red line, then a pale one, nearly white, *i. e.*, decidedly lighter than general ground-colour. Then a broader dark band, paler than the others owing to a good deal of marbling of pale ground-colour in it, in this is III. Then a very narrow whitish band and a very narrow brown (or reddish-brown) line in which is spiracle. Then a broad yellowish-white band in which are IV. and V. The anterior much the lower and the line of spiracle just between them. Then a narrow reddish band, a slightly broader pale one, and a narrow weakly-coloured dark one. Below this is the proleg with two hairs at margin, and on 1st and 2nd abdominal one hair in place of proleg, and another more ventral (this may be more in situation of proleg), a minute one still more ventral. No hair or tubercle is found on the three lines below the band carrying IV. and V. Legs and prolegs pale fleshy, four hairs and three dots like hairless tubercles on claspers. Head round, with fine wrinkling, making it rough. The anterior ocellus very large and prominent; the second smaller, but very similar and very close to it, the others flat and inconspicuous. The two first have pigment in the epicranium, as well as the mass beneath. The head also carries a number of hairs of the same colourless texture with rough surface, curved and clubbed, as those of the ordinary tubercles. The anal plate carries four hairs on conical tubercles along its posterior margin, and one in either side higher up. On the prothorax is a small plate on either side with four hairs, two in front and two further back. Further down in line with plate, and well above, and in front of spiracle, is a double tubercle of which the front hair is short and curved like the others, but the second though transparent and rough (not spiculated) like the others is straight,

and four or five times their length. Below is a tubercle with one very short clubbed hair. This is as much below spiracle as the double one is above it. Thoracic 2nd and 3rd have I. and II. single and in the same transverse line as is III. which is however double, it is exactly in line with III. abdominal. Below and quite to front of segment, is a single tubercle. This is below line of spiracle but above IV. and V. Lower is a single tubercle at base of leg (on prothorax two). Prolegs have six hooks in single line, claspers eight. The terminal bristle of the antenna rather long, three times the rest of the antenna, or nearly so. The bristles are rather longer than elsewhere, round the mouth region. The hairs of tubercles are very small, curved backwards and slightly clubbed, transparent, and with a roughened surface, in length, perhaps 0·06 mm.

The following are Mr. Powell's notes.

"*Erebia stygne.*

"Ova received from Dr. Chapman, July 21st, 1904.

"The eggs are fixed to blades of grass.

"*Shape.* Oval, with a flattened base concave in the centre. The top is only slightly flattened.

"*Appearance.* Pearly with a pinkish tinge, blotched with reddish-grey. Vertical ribbing quite distinct under hand-lens. Height, 1·2 mm. Greatest width, ·9 to 1 mm.

"*Under Microscope* × 50. There are 21 (sometimes 22) vertical ribs running from the edge of the base to the top, where they become rather lumpy and broken, dying out on the nearly smooth area around the micropyle. They are blunt-edged, with gently sloping sides. The cross ribs are numerous, and of course very much smaller and lower than the others. They constitute the long sides of cells, the tops of the vertical ribs forming the short sides. On the top of the egg the cells are large and irregular in shape, triangular, lozenge-shaped, etc. They diminish very much in size as they near the centre, in which is the invisible micropyle. There is no depression at the top, but in a *few* specimens the centre is occupied by a low, roughened pimple formed by a bunching-up of the lumpy ends of the ribs. The blotches observed under the hand-lens are seen to be composed of pinkish or chocolate-coloured specks arranged in loose groups.

"These groups are beneath the eggshell. That they are directly connected with the living contents of the egg

there is no doubt, for they can be seen to move backwards and forwards together, always keeping the same relative positions. The movement is a fairly brisk one, reminding one of a shrug of the shoulders. It can be induced by breathing upon the egg, or by giving a tap to the support on which it rests, but it occurs from time to time even when the egg is unmolested. Many other (perhaps all) *Erebiæ* ova develop these pinkish blotches after a few days. I have seen something similar in *Cœnonympha*. The base of the egg is covered with large shallow cells of irregular shape. Before hatching the colour darkens to dull fleshy grey, there being darker and lighter patches. The groups of specks disappear when this change takes place, and the shape and markings of the larva are seen through the shell. The head occupies all the upper part of the egg, while the body is curled round horizontally with the extremity turned downwards. The numerous pits on the head show through as brown dots. The two groups of beads (*ocelli*? one on each side) are very clear, so is the mouth and the arch above it. The markings of the body (lines and tubercles) are quite distinct. The larvæ commenced to hatch out on July 23rd, and all were out by the evening of July 24th. They eat away the top of the egg in a circle, emerge through the hole made, and eat up the rest of the egg or part of it.

"The newly-hatched larva is 28·mm. long when still, but can reach 3 mm. when walking. Width of the head 0·7 mm. It is a large head, and is higher and broader than the body, which tapers to begin with, down to the forks. The colour is that of most newly-hatched Satyrids, a sort of pale straw. The shape and markings of the head are typically Satyrid. It is rounded, rather flattened in front; much resembles a lemon rind in pitting and polish. The pits are large. Depression between the lobes very shallow. The side 'beads' (*ocelli*?) are large, dark brown, and shiny. The usual small, brown seta patches are very distinct. Setæ short, transparent, curved forward. Those just over the mouth are longest.

"The 1st division of the 1st thoracic segment has 16 small beady-brown tubercles arranged transversely but not in an exact line. The 2nd and 3rd thoracic segments have both a dorsal dark-brown tubercle-bead outside the dorsal stripe. In a line with it *on* the sub-dorsal stripe they have another bead. The abdominal segments have the first bead on the 1st sub-division, and in a line with those

on the thoracic segments. They have the second bead at the other end of the segment and *just above* the sub-dorsal stripe. Another line of large tubercle-beads (one in the centre of each segment and nearly in a vertical line with the spiracles) runs down the larva between the spiracular and supra-spiracular stripes. These last beads are *doubled* on the 2nd and 3rd thoracic segments. They generally approach the supra-spiracular stripe, entering its lower edge on the 6th abdominal segment and remaining in the stripe afterwards. Above the lateral border are two small beads, the first in the front of the segment, the other farther back and higher. All beads have short transparent hairs. The feet and claspers have each two or three beads bearing longer hairs than those on the body, with the exception of those growing from the tubercles on the 8th abdominal and anal segments.

"There are three conical tubercles on each fork (last segment) pointing backwards and giving rise to single, rather long, transparent hairs. One of these tubercles terminates the fork; the two others are lateral. The ground-colour of the body is a pale straw-grey. The stripes are pinkish-brown. Dorsal line weak on the thoracic segments, well-marked on abdominals. Sub-dorsal line narrower but better marked on the thoracic segments. Supra-spiracular and spiracular both well marked, the former thickening as it runs down the body, and continued along the edge of the forks. The space between the lateral edge and the spiracular line is very light. Beneath the edge, and therefore within the limit of the ventral surface, is a very narrow pinkish-brown line. The stripes are broken by the segmental and sub-segmental incisions. The dark colour does not penetrate the crevices. This is most marked in the case of the sub-dorsal and supra-spiracular stripes. Ventral surface, claspers and feet of the usual pale straw-colour. Forks: short, thick, and lying close. Claspers on last segment large, with several hair-bearing tubercles. The spiracles are round, dark-brown beads, no larger than the tubercles above them except on the 1st thoracic and 8th abdominal segments, but they are rather lighter in colour.

"The larvæ ate the grass I was able to give them, but it was too tough and dry to nourish them properly, so they soon died. No good grass was obtainable owing to the drought. In course of time I was able to improve the grass by watering, but it was then too late.

"*Erebia palarica.*

"Ova received from Dr. Chapman, July 21st, 1904.

"The eggs are fixed to blades of grass.

"As the egg is much like *stygne's* I will not go through all the details again, but will note the points of difference.

"*Size.* All those observed were distinctly smaller. Height, 1·0 mm. to 1·1 mm. Greatest width, 0·85 mm.

"*Colour.* Whiter.

"*Number of vertical ribs*, 22 to 24, none with less than 22.

"The arrangement of cells at the top of the egg is on the whole more regular, and the top looks smoother, but this is not always the case. None of the eggs have anything like a central pimple, however, as seen in a few *stygne*. I do not consider this is a good distinction, for I have noticed that in some Satyrids the top of the egg varies in the same species. *S. cordula*, for instance, has sometimes a decided cone around the micropyle owing to the bunching of the lumpy extremities of the ribs; in other specimens the top is fairly level.

"The specks beneath the shell are less numerous, and rather smaller. The groups are better defined, not so straggling; they are browner, not so pink. The same movement is observable.

"Before hatching, the eggs underwent similar changes to those noted in *stygne* but without becoming *quite* so dark. Hatching commenced on July 23rd, and all the young larvæ were out by the afternoon of the next day.

"*Larva* is smaller than *stygne*. Length, when first hatched, 2·6 mm., when walking, about 2·8 mm. Width of the head, about 0·6 mm.

"The larva is darker in appearance than *stygne* and that is on account of the stripes which are more strongly marked, especially the supra-spiracular stripe. The ground-colour is the same in both. If the larvæ are mixed together it is quite easy to separate them without any possibility of a mistake.

"I gave these larvæ *Brachypodium pinnatum*, but was unable to get any with fresh shoots. I also tried them with a *Festuca* which I had in a pot, but it had only a very few green blades. I tried them with a third grass, but nothing suited them, and they quickly dried up, *without having eaten anything at all*, as far as I could see. They perished several days before the *stygne* larvæ. *Stygne* ate *Brachypodium* and another grass, and if they could have got some fresh shoots I have no doubt they would have lived."

It may be proper to give a short diagnosis of:
Erebia palarica.

Colour and markings like *E. stygne*, except in the inner margins

of the elements of the red blotches, being notched and receding, instead of convex and advancing, in the under-side of ♂ hind-wing being often more distinctly marked, and in the red blotch in the ♀ upper wing being continued to costa as a whitish or greyish shade. Appendages, head of clasper more triangular and more definitely marked off by a narrower neck. Expanse 53–64 mm. Habitat, Cantabrian range at Puerto de Pajares, and Picos de Europa, and probably elsewhere.

I will place type specimens in the National Collection.

Erebia stygne, var. *peñalaræ*, is diagnosed in Proc. Ent. Soc., 1904, p. xlvi, from one specimen only. The series taken this year shows that the race is one of the most variable of *stygne*. Some are not very different from those taken at Pajares. Others are like that described, and not a few vary even more, so as to seem to be quite on the way to a form like *bejarensis*. The ♀♀ show more markedly than the males the remarkable inward extension of the red blotches, which is carried so far in *bejarensis*. In expanse it is smaller than the *hispanica* form from Canales, but larger than that from Pajares.

The two *evias* taken at Pajares are small, and are of different types, but are within the limits of variation of *E. evias*, var. *hispanica*, but a good way from its average type. The high-level ♀ is so very like the ♀ of *stygne* taken at the same time and place, that I did not recognize the specimen as *evias*, even when I had got it home and set it, and only discovered it on critically examining the specimens afterwards.

Mrs. Nicholl has kindly lent me three specimens, which I may note as a specimen of *E. stygne* of fairly ordinary type, 48 mm. in expanse, one of several taken on Mont Seny, 6000 feet, near Barcelona, date not given. Mont Seny is almost a spur of the Pyrenees; this specimen, with several taken by Mr. Burr, one over the frontier at Sallent, May 29th, 1904, proves, what we had no record of before, but which nevertheless every one supposed to be the case, that *E. stygne* occurs on the south as on the north slope of the Pyrenees, and no doubt more or less throughout the range, and probably abundant enough. The other two specimens are in response to my request to see the most extreme form of *evias* from the Albarracin district. One of these, expanse 50 mm., is a male taken early in July on the summit of Sierra Camarena (Javalambre,

6000 feet). This specimen is identical with not a few of those from Canales. The other is a very dwarf ♀ from Tragacete, June 29th. This is probably a genuine aberration as regards size, being only 40 mm. in expanse as compared with smallest from Canales, 44 mm., or both measured as set 38 mm. and 41 mm. Otherwise, as regards form, colour, markings, etc., it agrees exactly with various Canales specimens. These from their locality are true var. *hispanica*, Zapater, and go to show that *hispanica* is a high-level form of *evias*, in the Teruel district as elsewhere.

What we know of the geographical distribution of these butterflies is too fragmentary to take us very far, but it is sufficient to afford a few interesting considerations. Assuming the Erebias to have reached Spain *viâ* the Pyrenees, whilst it is just possible that *zapateri* may have reached the localities where it has developed its peculiar character by way of the coast hills, for the most part we find the Pyrenees so absolutely cut off from the rest of Spain, so far as mountain forms are concerned, by the wide and low valley of the Ebro, that the Erebias must first have travelled westward into the Cantabrian range before they could circle round the head waters of that river. It was probably at a very early date that *palarica* broke away from *stygne*, probably as early as the parting of *zapateri* from *neoridas*.

It is, however, with *stygne* and *evias* that we are more concerned. At the Picos de Europa, 180 miles west of Pyrenees, the two species are still but little differentiated from their mid-European types, nor is it clear that *evias* has a high- and a low-level form distinguishable from each other.

Mrs. Nicholl at Aliva on the high slopes of Peña vieja, 5000 feet, met on "July 12th with one poor *evias*, many *stygne*. July 14th, one nice ♀ climbing Peña vieja. July 17th, on the Col de las Nieves (at least 6500 feet) a few *evias*. July 18th, above Aliva, about 6000 feet, *evias* much battered, could scarcely get any good ones." She writes that she has in her collection only four specimens of *evias* from the Picos, "of which three are ♀♀, large and much spotted; I caught many that I did not keep as they were over, except a few very high up. They are very different to the small form from Aragon. The type of *stygne* was very common on all the Picos, up to the middle of July, on the southern and eastern sides of the range; I saw few

or none afterwards on the west and north faces of the same mountains, and I saw remarkably few butterflies on the west and north of the Picos."

There are, as I have already noted, two Picos *evias* in the B. M. collection; unfortunately they have only generalized labels, but one seems to be like the low-level forms, the other approaches the high-level one.

Going sixty miles further west to Pajares, we find *stygne* less abundant, its habitat even restricted, but common enough where it occurred. The three localities I most closely examined were, first, the high-level one already noted (over 6000 feet), I met with no other so high; with these a definitely high-level form of *evias*. Second, at the Puerto and extending for a mile along the north (Asturias) side of the col, but not apparently reaching very far either up or down from the 4500 feet level. The aspect would be N. and N.W. The third locality was nearly two miles below the col on the south side (Leon) at about 4250 feet, a comparatively small patch of a few hundred acres, with a westerly aspect.

We took specimens at a few other localities, but not in circumstances to enable us to say what might be the extent of the habitat, but generally these places had an easterly aspect and were at about 4500 or 5000 feet. One *evias* of doubtful high-level type not closely associated with these. These *stygne* from Pajares make a certain approach to the *hispanica* form, so that it is convenient to call them so, but many individuals are little if at all removed from the ordinary type.

It would be interesting to know what forms occur further west in the corner of Spain to the north of Portugal and in Portugal itself, but for the present this is a blank. The next point is at Canales to the south of the Ebro. Here *stygne* and *evias* are both modified by way of approach to each other, and fly together in about equal numbers. *Evias* probably has a low-level form here. The high-level one with *stygne* is of the form *hispanica*, but only a few reach typical *hispanica*, others still retain something of ordinary *evias*. The *stygne* is less variable than at Pajares, is two mm. larger and averages larger than the associated *evias*. Forty miles east of this, at Moncayo, the same form of *evias* is found, but we saw no *stygne*; possibly it does not occur there, as *stygne* seems to fail eastwardly, *evias* towards the west.

Passing now to the Guadarrama, S.W. from Canales something more than 100 miles, and at an elevation of 6000–8700 feet, we find a still more specialized form of *stygne*, very variable, from forms nearly typical to the peculiar *peñalaræ* and to forms as bright as *bejarensis*. These are associated with an equally specialized high-level *evias* of rather small size, and very different from the low-level form of the same region.

A hundred miles to the west of this is Bejar, at about 5000 feet. *Stygne* occurs in a very large highly-coloured form, but there is no record of *evias* with it. Nevertheless the association of the two species in the Peñalara and the approach made by many specimens of *stygne* there to the var. *bejarensis*, seems to lend a little further plausibility to my suggestion that *stygne*, var. *bejarensis*, owes its largeness and brightness to association with *evias*, though that species appears to have failed to go (at least in a high-level form) so far to the south and west.

A hundred miles east of Madrid in the Albarracin and neighbouring Sierras occurs *evias* apparently in ordinary large red form and in the special small yellow form, *hispanica*. I have no information to show whether these are in any sense a high- and low-level form. It seems certain that there is no *stygne* here. And a high-level *evias* apparently implies *stygne*. Nevertheless, I will venture the suggestion that *evias hispanica* in the Teruel district has, as it were, got there *viâ stygne*, even though that species could not follow, just the converse of what I suggest about *stygne bejarensis* to the west. The resemblance of the two forms of *stygne*, and the fairly continuous range of Sierra, from Peñalara to Bejar, would suggest that Bejar was reached *viâ* Guadarrama; whilst the Teruel district was reached from the Canales area, *viâ* the head-waters of the Duero and the Jalon, would be the conclusion for similar considerations in the case of *evias*. I saw no *stygne* in the Albarracin Sierra, and incline to believe it is really absent, the Sierra not being lofty enough, as it hardly comes below 7000 feet on the Guadarrama in same latitude; so far east in this latitude it is also possibly too dry.

Erebia palarica . .	Picos de Europa.	1902. Nicholl.
„ „ . .	Puerto de Pajares.	1904. T. A. C.

Erebia stygne stygne .	In Pyrenees (Spanish side). Burr. 1904.
„ „ „ or „ „ *hispanica*	Picos de Europa. Nicholl.
„ „ „ ×	Puerto de Pajares. T. A. C.
„ „ „ o	Canales de la Sierra. T. A. C.
„ „ *peñalaræ* ++	Guadarrama. Spanish Collection. Poulton. 1902. T. A. C. 1904.

Erebia evias evias . .	Picos, Guadarrama, Teruel and probably many other places in Spain.
„ „ *hispanica* ×	Approaching Puerto de Pajares. T. A. C.
„ „ „ o . .	Canales de la Sierra.
„ „ „ oo . .	Teruel.
„ „ *peñalaræ* ++	Guadarrama. Poulton. 1902.
„ *stygne bejarensis* oo	Bejar. T. A. C.

× associated.
o „
++ „
oo apparently unassociated with any form of the other species.

I add a Table of the expanses of the various forms of these species so far as my material allows.

	Stygne.		* *Stygne.*		* *Evias.*		* *Stygne.*		* *Evias.*		*Stygne.*		*Evias.*		*Evias.*		* *Stygne.*	
	Swiss.		Canales.				Peñalara.				Picos de Europa.				Pajares.			
Millimetres	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
38	1		...		...		...		...		...		...		...		...	
39			...		...		...		...		...		...		...		...	
40			...		...		...		...		...		...		...		...	
41			...		...		...		...		...		...		...		1	
42	2	2	...		...		...		...		...		...		...		1	
43	...		...		..		...		...		...		...		...		4	
44	...		...		1		2	1	...		...		...		...		5	2
45	1		1	1	5		2	1	...		1		...		●1		9	
46	...		...		4	1	3	2	...		1		○		1●		7	3
47	...		2	1	8	7	5	3	1●		2		...		...		13	3
48	...		11		12	4	1	2	...		...		...		...		9	1
49	...		6●	2	15	1	2	4	...		...		...		...		4	
50	...		5	1	7	1	1	2	...		...		...		...		1	1
51	...		5	3	4	2	2	1	..		...		○		...			1
52	...		3		3	1	...		...		...		...		...		1●	
53	...			1	...		...		...		...		...		...		...	
54	...		...		...		...		...		...		...		...		...	
55	...		...		...		...		...		...		...		...		...	
56	...		...		...		...		...		...		...		...		...	
57	...		...		...		...		...		...		...		...		...	
58	...		...		...		...		...		...		...		...		...	
59	...		...		...		...		...		...		...		...		...	
60	...		...		...		...		...		...		...		...		...	
61	...		...		...		...		...		...		...		...		...	
Total specimens	4	2	33	9	59	17	18	16	1	—	4	—	2	—	1	1	55	11
Mean expanse	42·0	46·0	49·0	49·4	48·3	48·2	47·2	47·8	47·0	—	46·2	—	48·5	—	46	45	46·24	47·0

Rühl.

* In these columns measurements are taken without allowance for setting, true expanses are therefore nearly 2 mm.

Mean expanse, or a solitary specimen.

* *Palarica.*		*Stygne.*		* *Bejarensis.*		*Evias.*		According to Ruhl.				
Pajares.		High Level Pajares.		Bejar.		Swiss.						
♂	♀	♂	♀	♂	♀	♂	♀					
...		...		...								
...		...		...								
...		...		...								
...		...		...								
...		...		...								
...		...		...								
...		...		...								
...		...		...								
...		...		1								
...		...		1								
...		...	1	3	2							
...		1 ●		4 ●			1					
...		...		3		2						
...		...		1	3		...					
	1	...		1	●	2						
1		...		2	2		...					
4	2	...		...		2	†					
9	3	...		...			...					
Picos.												
26	1 8	...			1		...					
28 ●	9 ●	...			1		...					
26	6	...		...			...					
12	3	...		...			...					
7	6	...		...			...					
2		...		...			...					
115	38	1	1	16	9	6	1					
57·2	57·25	49	47·6	49·7	52·	52·0	49					

Kane and Lang. — Ruhl.

Parmenio. — *Cyclopius.* — *Embla.* — 7 next largest *Erebia.*

Small Swiss *stygne* in B.M.
● *evias peñalaræ* type 47.
○ *stygne peñalaræ* type 44.

Largest Pyrenean (French) *stygne* in B.M.
● ○

reater than set down. *e. g.* Several *palarica* accurately measured are found to be 63 and 64 mm. in expanse.
† Two largest Swiss in B.M.

Explanation of Plates II, III, IV, V, VI.

Plate II.

Fig. 1. *Erebia palarica*, ♂ upper side.
2. „ „ „ under „
3. „ „ ♀ upper „
4. „ „ „ under „
5. „ *stygne* from Puerto de Pajares, ♂ upper side.
6. „ „ „ „ „ „ under „
7. „ „ „ „ „ ♀ upper „
8. „ „ „ „ „ „ under „
9. „ *evias*, var. *hispanica*, from Canales, ♂.
10. „ „ „ „ „ Pajares, ♀, only specimen of high-level form taken.

Plate III.

Fig. 1. *Erebia stygne*, ♂ Swiss, upper side.
2. „ *evias*, ♂ Digne „ „
3. „ *stygne*, var. *hispanica*, ♂, Canales, upper side.
4. „ „ „ „ ♀ „ „ „
5. „ *evias*, var. *hispanica*, ♂ „ „ „
6. „ „ „ „ ♀ „ „ „
7. „ *stygne*, var. *peñalaræ*, ♂ upper side.
8. „ „ „ „ ♀ „ „
9. „ „ „ „ ♀ under „
10. „ „ var. *bejarensis*, ♂ upper „
11. „ „ „ „ ♀ „ „
12. „ „ „ „ ♀ under „

Plate IV.

As a Plate this is open to criticism, but it shows what it is desired to do. Figs. 1 and 2 are *E. stygne*, and 3 and 4 *E. evias*, taken by Mrs. Nicholl at the Picos de Europa in 1902. The two species show some little approach to each other, but one at least of the *evias* is clearly the ordinary form, and these and other specimens leave it doubtful whether *E. evias* has here made any recognizable progress into the division into a large, bright, low-level, early form (*evias*) and a small, pale, high-level, late form (*hispanica*). Figs. 5 and 6 are Professor Poulton's two specimens, one *evias*, one *stygne*, from Peñalara. The *evias* (var. *peñalaræ*) is clearly a high-level form, but specially varied to agree with the *stygne* (var. *peñalaræ*) rather than quite like var. *hispanica*.

Plate V.

Sketch map of the northern half of Spain, showing habitats of *Erebia palarica* and of *E. stygne* and *evias* and their varieties. The lines connecting the stations for *evias* and *stygne* mark the progressive variation of *E. stygne* to successively vars. *hispanica* (Canales), *peñalaræ* (Peñalara) and *bejarensis* (Bejar), and of *evias* to vars. *hispanica* (Canales and Albarracin) and *peñalaræ* (Peñalara). Low-level (type) *evias* is more widespread (as the others probably are also) than is indicated on the map.

Plate VI.

Fig. 1. Eggs of *Erebia palarica* × 10.
2. „ „ *stygne* (Puerto de Pajares) × 10, both from photographs by A. E. Tonge, Esq.
3. Clasp of *E. palarica* × 24.
4. „ *E. stygne* × 24.

IV. *Another Entomological Excursion to Spain.* By George Charles Champion, F.Z.S., and Dr. Thomas Algernon Chapman, M.D., F.Z.S.; *with descriptions of two new species of* Hemiptera, by Prof. O. M. Reuter.

[Read February 1st, 1905.]

Plate VII.

The Puerto de Pajares is by no means unknown to naturalists, and even entomologists have visited the district, but so far as we know no lepidopterists have examined it. Herr Lucas von Heyden gives a rather full note on it in the account of his journey in Spain in 1865, in company with other entomologists (all coleopterists), which was published in 1870 by the Berlin Entomological Society. He especially dwells on the amenities of his quarters at Arbas, which was his *pied-à-terre* for the region, which reads very humorously. He found adequate quarters in the muleteers' cabin opposite the priest's residence, where men and beasts shared the lodging, and, the door being open, sudden charges of cats, fowls, and pigs were matters of course throughout the night. Arbas, Albas, Arvas, Abbas, seem to be varied spellings, of which Arbas is probably most correct and Arvas would give in English nearly the correct pronunciation. This place is about a mile to the south of the Puerto by the roadside, and consists of an old church or chapel with a priest's residence, a variety of cowsheds, of which one long row has living-rooms over and looks like a row in a colliery district. The Puerto de Pajares is at an elevation of about 4500 ft. and we selected it for our excursion, hoping to get lodgings at Arbas or at Busdongo (the town and railway station to the south of the Pass is at about 4200 ft.), or perchance at Pajares (the station to the north side of the Pass, the town being, however, below the station and rather below 4000 ft.).

On arrival at Busdongo, we heard we might perhaps be put up at the "tienda" of Señor Francisco Alonzo, at the Puerto itself, and it turned out that this establishment possessed three bedrooms for travellers, and though small and over the stables and piggeries, they served our purpose,

with less call on our philosophy than Herr von Heyden must have suffered. We remained here from July 3th—22nd.

Coming up from the south at Leon, the railway follows the valley, and has to make hardly any twists or spirals, to reach the Perruca tunnel, by which it pierces the col. But on the north face it emerges on a steep slope, and has to make many curves and zigzags to fall some 2500 ft. in half-a-dozen miles, running in fact over twenty actual miles of line. At the Puerto the road south follows the bottom of the valley at a regular and easy gradient. On the north side the floor of this valley is some 2000 ft. below and looks as if one could throw a stone into it. The mountains on the north side have very steep slopes, with bold outlines and rocky and precipitous summits, and there are many picturesque rocky outcrops. Although there are some bold rocks here and there in the southern valleys, generally speaking the hills are rounded and grassy, but often with very steep flanks. They have very little wood on the south side. On the north there is much beech wood, mixed with birch in the higher ground, little larger than coppice towards the Puerto, but with actual timber lower down. The region seems to be destitute of pine forests.

The general aspect of the country, as to physical features and vegetation, was more like portions of the Scotch Highlands than anything in the central portion of Spain that we visited. The country is, in fact, Atlantic and not Mediterranean, and has a rainfall that is not lacking at any season of the year, more than occasionally happens even in Scotland. Going into detail, however, the flora of course presented many plants unknown in the north, though heather, gorse, various pasture and bog grasses and other plants, such as *Senecio*, etc., were actually or nearly identical.

During most of our stay, we were much interested for practical as well as other reasons in a curious daily cycle that obtained. The early morning would be brilliantly fine, but by 8 or 9 o'clock, though it continued so to the south, the northern valleys would be filled by a sea of fog to within 500 or 1000 feet of the level of the Pass, with mountains and ridges standing out of it like islands, a light south wind blowing over the col; gradually the fog would rise like a flowing tide, and at length would reach

the level of the col, when it would pour over and down the valley with a north current. This would take place about 1 or 2 o'clock, earlier or later on different days. The fog would still rise with a steady north wind, gradually covering everything; in an hour or so the fog would be very wetting, and a little later would be actual rain, and this would usually continue till late in the night. The change of wind from south to north when the fog reached the level of the Pass was quite sudden and remarkable.

On the north side, an easy walk took us down to quite low ground, affording such insects as *M. galathea*, *E. hyperanthus*, *L. argiades*, and other low-level species, but we did not find anything of note. It was not therefore an attractive excursion, and, easy as it was to go down, the return was a very different matter.

In any other direction, one could not descend more than two or three hundred feet and then only to Busdongo, and usually we went up the valleys, on to the cols and hill tops above them, that ran down towards the main valley, of which there were several joining near Arbas, which was, in fact, very centrally situated for the best of these.

Apart from *Erebia stygne*, *E. evias*, and *E. palarica* noted elsewhere, we met with *E. epiphron*, *E. euryale*, and *E. tyndarus*; of the latter some specimens were of fairly normal (Swiss) form, but a fair proportion had more than the usual twin eye-spots, and one or two were larger and made a fair approach to var. *ottomana*. Of twenty-six specimens brought home, thirteen have more than the twin eye-spot, sometimes the one beneath these, sometimes the next lower, sometimes on one side only. Two specimens have both these spots and one of these measures 44 mm. in expanse. In six specimens these extra eye-spots are white-pupilled. The normal double spot has large white pupils in all specimens.

The *E. euryale* are 45 mm. in expanse (42 mm. smallest, 48 mm. largest). In two (out of twenty-two all ♂♂) there is a trace of white pupils to the eye-spots, two have four eye-spots in fore-wings and one has only two, the rest have the usual twin spots, one or two have the orange-red much as in var. *circellaris*.

The *E. epiphron* are rather close to var. *cassiope*, but are large for that variety.

Amongst the moths observed was *Cleogene peletieraria*

the white female of which was rare, but the nearly black males were frequent enough at various points near the Puerto amongst gorse and heath. This species has previously been recorded apparently only from the Pyrenees and on the French side.

Platyptilia isodactyla was common in the bogs near the Puerto, and some larvæ were reared from the egg to nearly full-grown, but died of starvation at La Granja.

Parnassius apollo was seen in many places, but was common on the *débris* from the railway tunnel at about 4200 feet. It was rather over (July 11th).

The abundance of a *Psyche* larva on certain slopes and pastures at about 6500 to 7000 feet was phenomenal, the cases were very like those of *Pachytelia villosella*, but are believed to be *Amicta febretta*; a number were brought home, but none have been reared, the larvæ moult into a colourless instar, preliminary to (hibernation and?) pupation. One became a pupa. The package containing these larvæ was lost on the way home and turned up three weeks later; it is comforting to attribute our want of success with them to this circumstance, but it is not perhaps certain. Perhaps they meant hibernating, and we may have some still alive doing so. It was a remarkable sight to see forty or fifty of these large cases within a square yard or so, either on the grass or on shrubs of *Cytisus purgans*; the larvæ did not seem very particular as to what they ate.

Mecyna polygonalis was one of the commonest moths seen, and varied from having the upper wings very dark, almost black, to pale yellowish, and some specimens were beautifully marked.

The following is a list of some of the species of Lepidoptera observed at Puerto de Pajares, and it will suffice to show the absence of specially Spanish forms.

Melanargia galathea
Erebia palarica
„ *stygne*
„ *evias*
„ *euryale*
„ *tyndarus*
„ *epiphron*
Pararge mæra
Cœnonympha arcanius
„ *pamphilus*
Aphantopus hyperanthus
Epinephele tithonus
Vanessa polychloros
Argynnis selene
„ *aglaia*
„ *lathonia*
Colias edusa
„ *hyale*
Pieris rapæ
„ *napi*
„ *brassicæ*
„ *daplidice*
Leptidia sinapis
Parnassius apollo

Polyommatus gordius
„ *phlæas*
„ *virgaureæ*, var. *miegii*
„ *dorilis*
Lampides telicanus
„ *bætica*
Lycæna astrarche
„ *hylas*
„ *corydon*
„ *arion*
„ *argiades*
„ *icarus*
Cyaniris argiolus
Hesperia malvæ
„ *alveus*
Carcharodus alceæ
Adopæa actæon

Procris geryon
Nemeophila plantaginis
Lasiocampa quercus
Plusia iota
Heliothis peltigera
Catocala conversa
Hepialus velleda

At La Granja (San Ildefonso, July 23rd—Aug. 3rd) we were too late for most things, but the impression left was that it was a most prolific station for many interesting species, and varieties, some of which are not very common but would be regarded as rarer but for their abundance in this fairly well-known locality. *Argynnis adippe*, var. *chlorodippe* and *cleodippe*, and *A. paphia*, var. *anargyra*, were both abundant but nearly over. *Melanargia lachesis*, var. *catalcuca*, perhaps a dozen seen. *Polyommatus virgaureæ*, var. *miegii*, rather a brilliant form. *Læosopis roboris*, common in the Palace grounds. *Cœnonympha iphioides*, at 5000—6500 feet.

Satyrus actæa abundant at Navacerrada and on a slope of Peñalara at nearly 7000 feet. At this station one very large specimen (rather worn while the others were fresh) was taken, that suggested (in size) *cordula* much more than *actæa*.

Orgyia aurolimbata, larvæ, pupæ, and imagines were common at the Puerto de Reventon (7000 feet).

Erebias and *Hetcrogynis* have been elsewhere referred to.

Cledeobia angustalis and *Rhodaria sanguinalis* were in many places perfect pests making it difficult to detect amongst them any other species.

On obtaining eggs of *P. virgaureæ*, var. *miegii*, we found that its food-plant, *Rumex acetosa*, was over for the season and growing material was obtained with difficulty. The butterflies, however, avoided the green plant and laid their eggs on the most mature and actually dead stems. This habit accords with the fact that though the larva develops in the egg in the autumn, the latter does not then hatch, but remains over till the spring.

The following are some of the butterflies seen at La Granja :—

Argynnis aglaia
„ *lathonia*
„ *paphia*, var. *anargyra*
„ *adippe*, vars. *chloro-dippe* and *cleodippe*
„ *niobe*
„ *daphne*
Melanargia lachesis
„ var. *cataleuca*
„ *iapygia*
Erebia styyne, var. *peñalaræ*
Epinephele tithonus
Satyrus semele
„ *actæa*
„ *statilinus*
Cœnonympha pamphilus
Cœnonympha arcanius
„ *iphioides*
Thecla ilicis
„ *quercus*
Læosopis roboris
Polyommatus hippothoe
„ *gordius*
„ *phlæas*
„ *virgaureæ*, var. *miegii*
Lampides bœtica
„ *telicanus*
Lycæna icarus
„ *astrarche*
„ *argyrognomon*
Augiades comma

Amongst the Coleoptera observed at the Puerto de Pajares, *Lytta vesicatoria* (which is usually of a cupreous tint in these southern localities) was perhaps the most in evidence, this insect swarming in places on the flowers of the *Genista*, as did two or three species of *Zonabris*. On this plant, too, or on broom, there were also to be found, *Corymbites hæmatodes*, var., *Athous reynosæ*?, various *Telephori*, *Rhagonycha*, and *Dasytes*, *Cryptocephalus lusitanicus* (varying to almost entirely black, and sometimes seen on heath also), *C. vittatus*, *Gynandrophthalma concolor* and *G. reyi*, *Anthophagus muticus* and sp.? (in numbers, insects not seen on the Bejar or the Guadarrama, or on Moncayo), *Anthobium* spp., *Phyllobius tuberculifer*, *Strophosomus* spp., etc. About the patches of snow, under stones, etc., were, *Bembidium pyrenæum* (which seems to be scarcely more than a form of the Alpine *B. glaciale*), in abundance, *Baris nivalis*, *Deltomerus nebrioides* (very rarely), *Zabrus neglectus*?, *Steropus lacordairei*, *Cymindis melanocephala*, *Stenus guynemeri*, etc. On a mountain ridge, or Puerto, at about 6500 feet elevation, amongst short turf, under dry dung, etc., many interesting insects occurred, as *Homapterus punctulatus* (taken by us previously on the Bejar), *Pedilophorus metallicus*, in abundance, but mostly dead, *Helophorus porculus*, *Hypera biglobosa* (singly), *Otiorrhynchus asturiensis*, a *Timarcha*, *Chrysomela rufofemorata* and *C. cantabrica*, etc. Under stones in various places on the mountains, were *Carabus macrocephalus* (very rarely), *Harpalus cardioderus*, *Nebria sobrina*, various *Calathi*, *Synuchus nivalis*, *Amara equestris*, *Notiophilus aquaticus*, etc.; and on the paths, or amongst the heath, *Cicindela*

sylvatica, two species of *Dorcadion* (one of them worn and nearly over), *Platycerus spinifer* (one specimen, probably knocked off the *Genista*), and others. In dung, various *Aphodii* were to be found, as *A. obscurus*, *A. scrutator*, *A. bonvouloiri*, and others, also *Ammœcius frigidus*, *Geotrupes pyrenæus*, *Emus hirtus*, and *Staphylinus pubescens*. Boggy places on the heath produced *Elaphrus uliginosus*, *Anchomenus sexpunctatus*, *Carabus arvensis*?, etc. On the Pass, two species of *Rhizotrogus*, *R. felicitanus* and *R. fuscus*, were occasionally seen in abundance on the wing in the forenoon, disappearing after midday. A descent into the valley on the northern side resulted in the capture of *Perileptus arcolatus*, on the banks of the river, *Aromia moschata*, var. *thoracica*, *Leptura fontenayi*, *Stranyalia attenuata*, etc. As usual, in all these Spanish mountains, a *Henicopus* (*H. heydeni*) abounded, the males clinging tightly to the grass stems and sometimes accompanied by individuals of the opposite sex.

List of Coleoptera found at the Puerto de Pajares.*

Cicindela sylvatica, L., not rare, and once seen captured by a large Asilid; *C. campestris*, L. *Carabus macrocephalus*, Dej., three specimens, on the mountains; *C. deyrollei*, Gory (? = *arvensis*, L.), in the marshy ground near the road; *C. lineatus*, Dej.?, fragments of a single specimen found on the mountains. *Notiophilus aquaticus*, L., and *N. palustris*, Duft. * *Elaphrus uliginosus*, F., one specimen, in the marshy ground near the road: we have not seen a record of this species from Spain. *Nebria sobrina*, Schauf., rarely. *Bembidium lampros*, Herbst; *B. pyrenæum*, Dej., in abundance, at the edge of the snow on the mountains; *B. stomoides*, Dej.; *B. nitidulum*, Marsh.; *B.* sp. n. *Perileptus arcolatus*, Creutz., on the banks of the river below Pajares. * *Deltomerus nebrioides*, Vuillefr., two specimens, on the mountains, near running water, issuing from the lowest patches of snow. * *Platynus sexpunctatus*, L., not rare in the marsh by the road. *Synuchus nivalis*, Panz., *Pterostichus nigrita*, F.; *P. cristatus*, Duf., var. *cantabricus*, Schauf. *Haptoderus cantabricus*, Schauf. *Orthomus barbarus*, Dej. *Pœcilus cupreus*, L. *Steropus lacordairei*, Putz. *Amara equestris*, Duft. * *Zabrus neglectus*, Schaum, var.?, not rare,

* The species marked with an asterisk are not included in v. Heyden's Asturian list.—Deutsche ent. Zeitschr. xxiv, pp. 281–304 (1880).

under stones on the mountains; *Z. asturiensis*, Heyd., one specimen. * *Harpalus cardioderus*, Putz.; *H. honestus*, Duft.; *H. rubripes*, Duft.; *H. psittaceus*, Fourcr., etc., under stones, on the mountains. * *Chlænius velutinus*, Duft. *Licinus planicollis*, Fauv. *Cymindis melanocephala*, Dej.

Limnebius nitidus, Marsh.? * † *Helophorus porculus*, Bedel, at roots of grass, high up on the mountains; *H. glacialis*, Villa, a species occurring on many of the mountains in Spain.

Alcochara fuscipes, F. * *Staphylinus pubescens*, De G. * *Emus hirtus*, L. * *Leistotrophus murinus*, L. * *Actobius prolixus*, Er. *Philonthus splendens*, F., in dung; * *P. fulvipes*, F., var. *varipes*, Rey, in a marshy place. * *Stenus guynemeri*, Duv., one specimen, near running water, as usual; *S. carbonarius*, Gyll. *Oxytelus laqueatus*, Marsh. * *Anthophagus muticus*, Kies., and *A.* n. sp.? (near *pyrenæus*, Bris.), both in numbers, on *Genista*, etc., females only of the second species obtained. *Omalium florale*, Payk.; *O. cæsum*, Grav. *Lesteva longælytrata*, Goeze. *Philorhinum nigriventre*, Rosenh. *Anthobium torquatum*, Marsh., and *A. adustum*, Kies., in plenty on *Genista*.

Silpha nigrita, Cr. *Pedilophorus metallicus*, Chevr., in numbers (but mostly dead) on a grassy mountain ridge, under dry dung, stones, etc. *Byrrhus pilula*, L., and *B. depilis*, Graells: this latter seems to be nothing more than an abraded form of *B. pilula*. *Hister unicolor*, L.; *H. carbonarius*, Ill. *Saprinus æneus*, F.

* *Platycerus spinifer*, Schauf., one specimen: apparently very rare in the Cantabrian Mountains, as it is not mentioned by v. Heyden. *Onthophagus fracticornis*, Preyssl., *O. lemur*, F., *O. furcatus*, F., *Aphodius fossor*, L., *A. scrutator*, Herbst, *A. fœtens*, F., *A. hæmorrhoidalis*, L., *A. rufescens*, F., *A. obscurus*, F. (in profusion), *A. rufipes*, L., *A. depressus*, Kug., *A. bonvouloiri*, Harold, more or less common in dung on the mountains. *Ammœcius frigidus*, Bris., in abundance, with the preceding. *Geotrupes pyrenæus*, Charp.; *G. typhæus*, L. *Rhizotrogus felicitanus*, Reitt., and *R. fuscus*, Scop., both in profusion on the wing in the hot sun in the forenoon, apparently males only obtained; *R. solstitialis*, L. * *Hymenoplia chevrolati*, Muls. * *Anisoplia bætica*, Er.

Betarmon vittatus, Cand., six specimens on *Genista*.

† This insect also occurs at Albarracin. It has been recorded by Bedel from Scotland!

Melanotus tenebrosus, Er. *Athous reynosæ*, Bris.?, *A. cervicolor*, Heyd., and various other species of the genus. *Limonius nigripes*, Gyll. *Corymbites latus*, F., *C. pyrenæus*, Charp. ?, and * *C. paulinoi*, Desbr., rarely. *C. hæmatodes*, F., var. ?, about a dozen specimens, all females, varying greatly in size. *Hydrocyphon deflexicollis*, Müll., two specimens, by the stream in the valley.

* *Lampyris noctiluca*, L., females only obtained. *Telephorus abdominalis*, F., *T. rufus*, L., *T. bivittatus*, Mars., *Rhagonycha cantabrica*, Heyd., *R. genistæ*, Kies., *R. hesperica*, Baudi, and others, mostly on *Genista*. *Antholinus amictus*, Er., on *Genista*. *Henicopus heydeni*, Kies., in plenty, on grass-stems: there seem to be two forms of the female of this species wherever it occurs—one with black, the other with grey hair. *Dasytes* spp. ?, *Danacæa* spp. ?

Heliopates lusitanicus, Herbst. ? * *Cteniopus sulphureus*, L. *Isomira hispanica*, Kies. ?, *I. murina*, L., var., both on *Genista*. *Mordella aculeata*, L. *Anthicus antherinus*, L. * *Meloe brevicollis*, Panz. *Zonabris solrina*, Graells, and * *Lytta vesicatoria*, L., in profusion, on *Genista*. *Œdemera nobilis*, Scop., * *O. podagrariæ*, L.

Otiorrhynchus asturiensis, Chevr., not rare on the mountains; *O. pyrenæus*, Gyll., one specimen. * *Homapterus punctulatus*, Bris., not rare, on a mountain ridge, under dry dung, etc.; we had previously met with this insect on the Sierra de Bejar.† *Phyllobius tuberculifer*, Chevr., on *Genista*. *Strophosomus* spp. *Barynotus pyrenæus*, Bris., one worn specimen. *Sitones regensteinensis*, Herbst. *Hypera biglobosa*, Kirsch, one specimen. *Cleonus nigrosuturatus*, Goeze. *Anisorrhynchus hespericus*, Desbr. * *Baris nivalis*, Bris., one specimen. *Ceuthorrhynchus ericæ*, Gyll. *Cionus blattariæ*, F. *Apion ulicis*, Forst. *Rhynchites betulæ*, L.

Leptura fontenayi, Muls., *Strangalia attenuata*, L., and *Aromia moschata*, L., var. *thoracica*, Fisch., on the road to Puente de los Fierros. *Dorcadion castilianum*, Chevr. ?, and *D.* sp. ? (mostly rubbed and over), occasionally on the mountain paths.

Lema lichenis, Voet. *Labidostomis lusitanica*, Germ. * *Gynandrophthalma concolor*, F., common, and * *G. reyi*, Bris., rarely, on *Genista*. *Cryptocephalus lusitanicus*, Suffr., many specimens, on *Genista*, etc., all belonging to dark varieties, some of them wholly black, with the exception of two minute spots on the head, the lateral margins of the

† Recorded by us from Bejar under the name of *H. affinis*, Chevr.

prothorax and the scutellum; **C. vittatus*, F.; *C. sericeus*, L.; *C. tibialis*, Bris.; *C. mystacatus*, Suffr.; *C. moræi*, L., and vars. *Gastroidea janthina*, Suffr., with its larva, on *Rumex*, along the roadside, at the summit of the Pass. *Timarcha asturiensis*, Kr. *Chrysomela hæmoptera*, L., *C. rufofemorata*, Heyd., *C. cantabrica*, Heyd., on the mountains; *C. menthastri*, Suffr. ** Orina cacaliæ*, Schr., two specimens. ** Phytodecta variabilis*, Oliv., *P. olivacea*, Forst. *Phyllodecta vitellinæ*, L. *Luperus nigrofasciatus*, Goeze, common on *Genista*. *Luperus* sp. ** Malacosoma lusitanicum*, L. *Haltica* sp. ?, common on heath.

List of Hemiptera-Heteroptera found at Puerto de Pajares.

Carpocoris purpuripennis, De G. *Therapha hyoscyami*, L. *Lygæus equestris*, L., *L. pandurus*, Scop. *Geocoris ater*, F., under stones, on the mountains. *Orthostira macrophthalma*, Fieb., with the preceding. *Nysius senecionis*, Schall. *Stygnocoris fuligineus*, Fourcr. *Emblethus angustus*, Mont. *Aphanus pini*, L. *Heterogaster artemisiæ*, Schill. *Harpactor iracundus*, Poda. *Nabis rugosus*, L. *Calocoris sexguttatus*, F. *Pachytomella cursitans*, Reut., n. sp., in profusion, amongst short grass on the mountains. *Capsus scutellaris*, F. *Strongylocoris leucocephalus*, L., var. *steganoides*, Sahlb. *Heterocordylus tibialis*, Hahn.

In the immediate vicinity of La Granja there were but few beetles to be found at the end of July, and even on the mountains the characteristic *Dorcadions* were almost over. We obtained, however, an interesting *Cryptocephalus*, *C. 5-punctatus*, and *Cneorrhinus pyriformis*, on young oaks, on the "flat" east of the Palace Gardens. At the sources of the small streams, in the upper part of the pine forest, under chips and stones, we found the very local *Leistus constrictus*, *Carabus ghilianii*, *C. guadarramus*, and *C. helluo*, *Steropus ghilianii*, *Haptoderus nemoralis*, and others. Higher up, above the pine forest, at or near the sources of the streams issuing from the patches of melting snow, we again met with the *Leistus*, and here accompanied by *Nebria vuillefroyi* (mostly immature), *Zabrus seidlitzi*, *Otiorrhynchus truncatellus*, *Bembidium ibericum*, *B. laterale*, etc. Around the Laguna de los Pajaros, on the south side of the Peñalara, on which there were various patches of snow, a variety of interesting species were obtained,

including a *Pedilophorus* (apparently new), *Bembidium carpetanum* (at the edge of the melting snow, in abundance), *Dichotrachelus graellsi, Trechus pandellei*?, *Cathormiocerus chevrolati*, etc., and in the lagoon itself *Esolus angustatus, Laccynia carinata, Deronectes griscostriatus*, and others. Myriads of winged ants were sometimes found floating on the surface of this lagoon, probably carried there by the wind. On the short turf hereabouts, from which a large number of vultures (looking like a flock of sheep, as seen from the ridge above) were disturbed on one of our visits, a *Timarcha* abounded, and the two local *Dorcadions* (so abundant in early summer) were still represented by a few worn examples. Near the Puerto de Reventon the brilliant *Geotrupes coruscans* was seen in numbers, flying in the hot sunshine, and at the Puerto de Navacerrada *Cyrtonus montanus, Misolampus scabricollis*, etc., occurred under stones. The pine stumps and logs produced three species of *Liodes* (as in Scotland), *Læmosthenes pinicola, Spondylis buprestoides, Sphindus dubius*, a *Bothrideres*, a *Plegaderus, Paromalus flavicornis, Eniemus rugosus, Lygistopterus sanguineus*, etc. About a waterfall, on the way to the Reventon, *Geodromicus nigrita* was taken, in company with various species of *Hydroporus, Helophorus, Bembidium*, etc. *Chlænius dives* was occasionally seen, and a *Thylacites* occurred not uncommonly, as usual under stones exposed to the full glare of the sun. On flowers but few insects were to be found beyond *Cerocoma schreberi*, one or two *Zonabris*, and *Leptura stragulata*. Though too late for most of the beetles, we were, however, at the right time for the Capsidæ, various interesting species of *Phytocoris* being plentiful on oak, etc., though very difficult to catch when beaten into an umbrella. Part of our success here was due to the kind assistance of our old friend Señor Ignacio Bolivar, whom we were fortunate enough to meet on one of our excursions to the Sierra.

List of Coleoptera found at La Granja (including the Peñalara).

Carabus ghilianii, Laf., *C. guadarramus*, Laf., and *C. helluo*, Dej., under stones, especially about the sources of the small streams, at the upper limits of the pine forest, the first-mentioned species the most common. *Leistus constrictus*, Schauf., a few specimens, at the sources of the small streams, and also about the lowest patches of snow; it is exceedingly active, and difficult to secure in

perfect condition; on one occasion about a dozen examples were found under the bark of a pine stump, on the banks of a small stream, but few of them, however, were captured without injury. *Nebria vuillefroyi*, Chaud., not rare, but mostly immature at this season, under stones and moss, in the streams issuing from near the melting snow. *Tachypus cyanicornis*, Pand. *Bembidium pyrenæum*, Dej. (var. *carpetanum*, Sharp), abundant, at the edges of the snow patches on the Peñalara; *B. decorum*, Duft.; *B. ibericum*, Pioch.; *B. laterale*, Dej.; *B. hypocrita*, Dej.; *B. toletanum*, Perr. *Tachys parvulus*, Dej. *Trechus pandellei*, Putz. ?, plentiful, at the edges of the snow on the Peñalara. *Platyderus montanellus*, Graells. *Haptoderus nemoralis*, Graells, plentifully, with the *Leistus*. *Læmosthenes pinicola*, Graells. *Steropus ghilianii*, Putz., not rare, under stones. *Zabrus seidlitzi*, Schaum, common on the mountains. *Chlænius dives*, Dej., on the mountain slopes, running about in grassy places.

Deronectes griseostriatus, De G., *Hydroporus flavipes*, Oliv., etc., *Agabus heydeni*, Wehncke, *A. guttatus*, Payk., *A. conspersus*, Marsh., *Helophorus glacialis*, Villa, *Hydræna* sp., *Esolus angustatus*, Müll., *Larcynia carinata*, Perez, *Limnius* sp., etc., in the Laguna de los Pajaros, on the Peñalara, or in the streams lower down.

Echidnoglossa glabrata, Kies., one specimen, on the mountains. *Atheta luctuosa*, Rey, and others of the genus, at the edges of the snow, on the Peñalara. *Baptolinus alternans*, Grav., in the pine stumps. *Geodromicus nigrita*, Müll., at the edge of a waterfall near La Granja.

Liodes humeralis, Kug., *L. castanea*, Herbst, and *L. glabra*, Kug., *Agathidium piceum*, Er., *Enicmus rugosus*, Herbst, *Bothrideres interstitialis*, Heyd., *Plegaderus saucius*, Er., *Paromalus flavicornis*, Herbst, under bark of pine stumps. *Phalacrus maximus*, Fairm. *Olibrus bisignatus*, Mén., *O. bimaculatus*, Küst., *O. pygmæus*, Sturm, on flowers, near La Granja. *Pedilophorus* n. sp. (belonging to the subgenus *Trichobyrrhulus*, Ganglb.), two specimens, near the snow, Peñalara.

Copris lunaris, L., *Aphodius fœtens*, F., *A. scrutator*, Herbst, *A. bonvouloiri*, Harold, *A. obscurus*, F., *Ammœcius frigidus*, Bris., *Onthophagus schreberi*, L., *Oniticellus flavipes*, F., *Gymnopleurus flagellatus*, F., *Geotrupes coruscans*, Chevr., etc., in dung on the mountains, the *Geotrupes* frequently taken on the wing in the hot sun. *Rhizotrogus pygialis*, Muls. *Serica mutata*, Gyll.

Corœbus æneicollis, Vill. *Anthaxia millefolii*, F. *Melanotus dichrous*, Er.

Lygistopterus sanguineus, L., on the pine stumps. *Trichodes ammios*, F., *T. apiarius*, L. *Sphindus dubius*, Gyll., in powdery fungus on pine stumps.

Micrositus ulyssiponensis, Germ., under stones. *Misolampus scabricollis*, Graells, under stones, Puerto de Navacerrada. *Lagria rubida*, Graells (*parvula*, Perr.). *Mordellistena neuwaldeggiana*, Panz. *Zonabris hieracii*, Graells, *Z.* 4-*punctata*, L., *Z. variabilis*, Pall., *Z. dejeani*, Gyll., *Z. geminata*, F., etc., and *Cerocoma schreberi*, F., more or less abundant on flowers. *Œdemera podagrariæ*, L.

Otiorrhynchus truncatellus, Graells, not uncommon on the Guadarrama, occurring even on the summit of the Peñalara. *Strophosomus crinaceus*, Chevr.; *S. ebenista*, Seidl., a common insect on the Guadarrama, and often found in numbers under stones. *Cathormiocerus chevrolati*, Seidl., and *Dichotrachelus graellsi*, Perris, near the snow, Laguna de los Pajaros. *Cneorrhinus pyriformis*, Boh., not rare, on oak bushes near the town: two forms of the female were met with (as in the species found on *Genista* at Piedrahita in 1902), one green, the other grey, like the male, the latter being less elongate than the corresponding sex of the Piedrahita insect; the scales of the green females from La Granja are opaque, while in those from Piedrahita they are metallic.* *Thylacites* sp., common, under stones, in bare hot places. *Brachyderes lusitanicus*, F., *B. incanus*, L. *Pachytychius scabricollis*, Rosenh. *Polydrosus setifrons*, Duv. *Brachytemnus porcatus*, Germ., in the pine stumps. *Ceuthorrhynchus biscutellatus*, Chevr. *Balaninus pellitus*, Boh. *Orchestes avellanæ*, Don., *O. ilicis*, F., *O. quercus*, L. *Rhamphus flavicornis*, Herbst. *Apion atomarium*, Kirby, *A. craccæ*, L., *A. pomonæ*, F., *A. vorax*, Herbst, etc. *Attelabus curculionoides*, L. *Hylastes palliatus*, Gyll.

Spondylis buprestoides, L., a common species in the pine forest. *Vesperus brevicollis*, Graells, two males beaten from oak. *Criocephalus* sp., in the pine forest. *Leptura stragulata*, Germ., *L. rubra*, L., *L. livida*, F. *Dorcadion graellsi*, Graells, *D. hispanicum*, Muls., Laguna de los Pajaros, Peñalara, not rare, but worn, both species being almost over in July.

Titubœa biguttata, Oliv. *Lachnæa pubescens*, Duf., *L. sexpunctata*, Scop. *Cryptocephalus* 5-*punctatus*, Harr.,

* *Cf.* Trans. Ent. Soc. Lond. 1903, pp. 176, 177.

sparingly, on young oak bushes on the "flat" outside La Granja: we have not seen a record of this conspicuous species from Spain, and it is not represented in the Madrid Museum; *C. sexmaculatus*, Oliv., *C. globicollis*, Suffr., *C. moræi*, L. *Cyrtonus montanus*, Graells, Puerto de Navacerrada, nearly over in July. *Timarcha* sp., in abundance, Laguna de los Pajaros. *Chrysomela hæmoptera*, L.; *C. rufoænea*, Suffr. *Hispa atra*, L. *Cassida margaritacea*, Schall. *Halyzia* 12-*guttata*, L., *H.* 18-*guttata*, L. *Adonia mutabilis*, Scriba. *Coccinella* 14-*pustulata*, L. *Exochomus* 4-*pustulatus*, L., *E. auritus*, Scriba.

List of Hemiptera-Heteroptera found at La Granja.

Eurygaster maura, L. *Graphosoma lineatum*, L. *Sehirus dubius*, Scop., *S. maculipes*, M. and R. *Ælia rostrata*, Poh. *Neottiglossa leporina*, H.-S. *Staria lunata*, Hahn. *Eurydema festivum*, L., *E. oleraceum*, L. *Tropicoris rufipes*, L. *Carpocoris purpuripennis*, De G. *Verlusia quadrata*, F. *Centrocoris spiniger*, *F. Gonocerus juniperi*, H.-S. *Therapha hyoscyami*, L. *Corizus crassicornis*, L., *C. parumpunctatus*, Schill., *C. tigrinus*, Schill. *Lygæus equestris*, L., *L. pandurus*, Scop., *L. superbus*, Poll. *Nysius thymi*, Wolff. *Cymus glandicolor*, Hahn, *C. melanocephalus*, Fieb. *Heterogaster artemisiæ*, Schill. *Macroplax fasciata*, H.-S. *Microplax interrupta*, Fieb. *Aphanus pini*, L. *Taphropeltus championi*, Reut., n. sp. *Beosus maritimus*, Scop. *Emblethis angustus*, Mont. *Monanthia echii*, Wolff. *Serenthia læta*, Fall. *Phymata crassipes*, F. *Aradus flavicornis*, Dalm., one specimen, in the Laguna de los Pajaros. *Coranus subapterus*, De G. *Nabis ferus*, L. *Salda cocksi*, Curt. *Cryptostemma alienum*, H.-S. *Piezostethus terricola*, Reut., under a stone on the mountains. *Miris lævigatus*, L., *M. calcaratus*, Fall. *Megaloceræa erratica*, L. *Lopus gothicus*, L. *Phytocoris meridionalis*, H.-S., abundant, and *P. rittiger*, Reut., *P. varipes*, Boh., *P. femoralis*, Fieb., *P. abcillei*, Puton, and *P. albofasciatus*, Fieb., more rarely, on oak, etc., but very difficult to secure. *Megaloceelum infusum*, H.-S. *Adelphocoris lineolatus*, Goeze. *Pœciloscytus unifasciatus*, F. *Brachycoleus triangularis*, Goeze. *Cyphodema instabile*, Luc. *Camptobrochis lutescens*, Schill. *Capsus ruber*, L. *Pilophorus cinnamopterus*, Kb., and *P. perplexus*, Scott, on oak. *Oncotylus bolivari*, Reut. *Sthenarus ocularis*, M. and R. *Dicyphus genieulatus*, Fieb. *Corixa mœsta*, Fieb.

From La Granja we went on to Madrid, spending a day or two there to visit the Museum, etc. Leaving Madrid on Aug. 5th, we proceeded northward to Navalperal (4165 ft.), in the Province of Avila, and at the western extremity of the Guadarrama. Here we were joined by the Spanish entomologist, Manuel Escalera, who accompanied us to the "Pinar" of Las Navas, etc. The partially-dried-up streams at this place furnished a large number of water-beetles, *Deronectes carinatus* being particularly abundant, and on the sandy banks we found *Acylophorus glabricollis*, various *Bembidia*, etc. In the pine forest we obtained divers Longicornia and other beetles, from the earthen-ware cups placed on the pine trunks to catch the exuding resin, such as *Nothorrhina muricata*, *Ergates faber*, *Temnochila cærulea*, etc. Our time, however, at Navalperal was limited, and we finished our collecting here by catching several males of *Vesperus brevicollis*, just before commencing our long homeward journey. It may be worth noting, perhaps, that at Irun, on July 7th, we observed *Hylotrupes bajulus* in numbers on the telegraph posts, in which the females were depositing their eggs.

List of COLEOPTERA found at Navalperal.

Bembidium clonyatum, Dej., *B. octomaculatum*, Goeze. *Bidessus geminus*, F., *B. minutissimus*, Germ. *Hydroporus halensis*, F., var. *fuscitarsis*, Aubé, in profusion, *H. flavipes*, Oliv., *H. varius*, Aubé, *H. lepidus*, Oliv., *H. marginatus*, Duft., *H. lituratus*, Brullé, *H. discretus*, Fairm., etc. *Deronectes carinatus*, Aubé, in abundance. *Agabus brunneus*, F., *A. didymus*, Oliv., *A. chalconotus*, Panz. *Ilybius fuliginosus*, F. *Dytiscus pisanus*, Lap. (♀), *D. marginalis*, L. (♂ and ♀), *D. punctulatus*, F. *Gyrinus urinator*, Ill. *Hydrophilus flavipes*, Stev. *Limnoxenus oblongus*, Herbst. *Hydrobius fuscipes*, L. *Helochares* sp. *Paracymus æneus*, Germ. *Hydrochus* sp. *Hydræna testacea*, Curt., *H. riparia*, Kug., *H. nigrita*, Germ. *Pelochares versicolor*, Walk. *Acylophorus glabricollis*, Lac. *Philonthus suavis*, Bris., *P. umbratilis*, Grav., *P. quisquiliarius*, Gyll. *Phalacrus maximus*, Fairm., not rare on flowers. *Meligethes exilis*, Sturm, with the preceding. *Temnochila cærulea*, Oliv., *Anthaxia* 4-*punctata*, L., *Melanotus dichrous*, Er., *Rhizotrogus neglectus*, Perez, *Nothorrhina muricata*, Dalm., *Ergates faber*, L., and *Criocephalus* sp., *Hylurgus ligniperda*, L., *Tomicus sexden-*

tatus, Boern., in or about the earthenware cups fastened on the pines to catch the exuding resin; many of the specimens had been thus trapped, and were so coated with resin that they had to be immersed in benzine or turpentine before they were of any use. *Lygistopterus sanguincus*, L. *Clerus formicarius*, L. *Cerocoma schreberi*, F. *Zonabris geminata*, F., *Z. variabilis*, Pall. *Brachyderes suturalis*, Graells, on pines. *Cleonus marmottani*, Bris. *Lixus iridis*, Oliv., in the stems of a large Umbellifer; *L. ascanii*, L. *Pissodes notatus*, F. *Rhynchites cæruleocephalus*, Schall., on *Cistus*. *Vesperus brevicollis*, Graells, males attracted to an acetylene lamp placed by Señor Escalera outside a house in the village for the purpose of catching moths.

List of HEMIPTERA-HETEROPTERA found at Navalperal.

Ancyrosoma albolineatum, F. *Ælia acuminata*, L. *Eurydema festivum*, L. *Phyllomorpha laciniata*, Vill. *Centrocoris spiniger*, F. *Syromastes marginatus*, L. *Camptopus lateralis*, Ger. *Neides tipularius*, L. *Lygæus saxatilis*, Scop. *Nabis ferus*, L., *N. rugosus*, L. *Gerris gibbifer*, Schml. *Corixa sahlbergi*, Fieb., *C. transversa*, Fieb., *C. semistriata*, Fieb.

Descriptions of two new species of Hemiptera-Heteroptera *from Spain.* By Prof. O. M. REUTER.

Taphropeltus championi, n. sp.

Fusco-ferrugineus, $\frac{2}{3}$ apicalibus marginum lateralium pronoti anguste pallidis, $\frac{1}{3}$ horum basali nigro-fusco; clava tertiaque basali parte corii testaceis, illo apice sat late nigro-fusco, corio cetero nigro-fusco, macula marginali fere in tertia apicali parte posita albido-flavente, membrana infuscata, venis obscurioribus, macula oblonga exteriore suturam membranæ terminante; antennis modice gracilibus, obscure ferrugineis, articulo secundo apice tertioque nigro-fuscis, quarto flavo-testaceo, basi nigro-fusco; pedibus cum coxis flavo-testaceis vel flavo-ferrugineis, femoribus anticis (♀) modice incrassatis, spinulis duobus instructis et inter eas et apicem subtiliter denticulatis, spinula posteriore supra medium posita, tibiis anticis sat fortiter arcuatis.

Long. ♀ $2\frac{2}{3}$ mm.

Hab. SIERRA DE GUADARRAMA, La Granja.

T. contracto, *H.-Sch.*, minor, colore corporis, antennarum et pedum, pronoto magis æquali, lobo antico ejus parum convexo, sulco transversali minus distincto, spinula posteriore femorum anticorum basi magis appropinquata mox distincta. Caput omnium creberrime et subtilissime punctatum. Antennæ articulo secundo latitudini verticis oculique unici æque longo, ultimis apice ejus paullo crassioribus, tertio secundo circiter $\frac{1}{4}$ breviore, quarto secundo fere æque longo. Rostrum pallide flavens, coxas intermedias attingens. Pronotum sulco transversali pone medium sito, parte apicali parum convexo, creberrime subtiliter punctata, parte basali concolore, minus crebre et paullo fortius punctata. Scutellum ut pars basalis pronoti punctatum. Clavus triseriatim punctatum. Corium apicem versus obsoletius punctatum.

Two specimens.

Pachytomella cursitans, n. sp.

Nigra, nitens, pronoto postice hemielytrisque omnium subtilissime cinereo-pubescentibus; antennis pedibusque utriusque sexus totis nigris; vertice haud vel obsoletissime marginato et utrinque ad oculum obtuse depresso, fronte fortiter convexa, clypeo basi a fronte impressione bene discreto; antennis articulo secundo latitudine verticis interoculari parum longiore (♂) vel hac circiter $\frac{1}{3}$ breviore, gracili (♀); hemielytris crebre sat fortiter coriaceo-punctulatis; mare feminaque (plerumque) brachypteris; capite formæ brachypteræ basi pronoti æque lato; dorso abdominis feminæ leviter ænescente.

Long. ♂ $1\frac{3}{5}$', ♀ $1\frac{2}{3}$ mm.

Hab. Cantabrian Mountains, Puerto de Pajares.

P. doriæ, *Ferr.* et *Reut.*, affinis et similis, corpore superne nigerrimo haud chalybeo-nitente, quamvis valde nitido, glabro, solum pronoto postice hemielytrisque omnium brevissime et subtilissime cinereo-pubescentibus, his fortius coriaceo-punctatis, antennis brevioribus pedibusque utriusque sexus totis nigris divergens. Corpus formæ brachypteræ breviter ovale (♂) vel late ovatum (♀). Caput formæ brachypteræ a supero visum pronoto longitudine æquale vel subæquale, ab antico visum latitudini verticis oculique unici fere æque longum, vertice oculo fere $2\frac{1}{2}$ (♂)—triplo (♀) latiore, clypeo retrorsum vergente, genis altis, gula haud distinguenda. Oculi retrorsum vergentes, angulis anticis pronoti incumbentes. Antennæ ad (♂) vel paullo infra (♀) apicem oculorum interne insertæ, articulo primo apicem clypei haud attingente, secundo versus apicem sensim incrassato, feminæ quam maris

graciliore, duobus ultimis simul sumtis secundo paullo longioribus, quarto tertio breviore. Pronotum formæ brachypteræ basi longitudine duplo (♂) vel magis quam duplo (♀) latius, apice quam basi parum angustius, disco horizontali, antice foveolis quatuor in arcum positis, postice subtiliter striguloso, margine basali late sinnato. Hemielytra formæ brachypteræ apicem segmenti quarti (♂) vel basin segmenti tertii (♀) dorsalis attingentia, tota coriacea, commissura scutello distincte longiora (♂) vel huic æque longa (♀), margine apicali valde obliquata (♂) vel subrecte truncata (♀), angulo exteriore subrecto (♀) vel acutiusculo, rotundato (♂).

Many specimens.

Explanation of Plate.

Plate VII.

The Monastery of Santas Arbas, about a mile south of the Pass of Pajares, and near the confluence of several valleys on the southern side.

V. *The Egg and Early Larval Stages of a Coreid Bug, probably* Dalader acuticosta, Amyot et Serv.; *with a note on its Hymenopterous Parasite.* By Nelson Annandale, B.A., Deputy Superintendent of the Indian Museum, Calcutta.

[Read November 16th, 1904.]

Plate VIII.

So little is known regarding the life history of the Heteroptera that I have ventured to bring forward certain observations on this subject which are confessedly most incomplete. Possibly my figures and descriptions may be of value to some naturalist more fortunate in rearing the insect to be considered than I have been.

I.

On August 14th last, at Alipur in the suburbs of Calcutta, I found, attached by a spider's web to a tree-trunk, a dead leaf on which were 14 eggs. They were arranged separately, roughly in parallel rows but in no very definite manner. Their length was about 2·75 mm.; their height 1·9 mm.; their colour a rich golden-brown, shining and lustrous. As the embryo developed they became darker. Examination with a lens showed that the surface was patterned with a minute reticulation, and that a cordiform or sub-oval area was marked off at the broader end. This proved to be an operculum. Another area, of greater extent than the last, but having identical limits above was indicated. It was evidently due to internal structures partially revealed by the translucency of the egg-shell. In this region there were several extremely minute punctures, which were only seen under a fairly high power of the microscope. They were arranged in an arc round the upper limits of the operculum and were undoubtedly micropyles: they are too small to appear in the figure. The eggs were fastened to the leaf by a drop of a gummy substance less brittle and more elastic than that of the egg-shell. It was situated near the centre of the flattened base.

During the night between August 18th and 19th, each egg produced a young Heteropteron. The operculum was pushed out bodily and did not remain attached at any point to the remainder of the egg-shell. What I take to be the embryonic exuviæ were left hanging from the upper part of the aperture thus formed in a heart-shaped mass, the free apex of which was produced into a delicate filament. The mass was also attached to the base of the egg-shell by a stouter filament, which originated above as a ridge on the inner surface of the mass. On the external face was a very conspicuous black spot, the nature of which I have been unable to determine.

In what manner the operculum was pushed out I cannot say, as I did not see the hatching. It appeared to be very firmly attached to the remainder of the shell although its limits were clearly defined to the eye. There was nothing of the nature of a hardened projection on the head of the larva when hatched.

The young bugs in their first instar measured 4·5 mm. in length. There was no visible difference in size between the different individuals of the brood. The head was squarish, but slightly rounded behind; the eyes were fairly large, but not prominent; I could detect no ocelli. At first sight the antennæ appeared to be five-jointed, but a closer examination showed that the first apparent joint was really a projection from the head: they were inserted into the upper part of the head. The rostrum originated close to the anterior margin of the head and was freely movable; only three joints could be detected in it with certainty. The tarsi appeared to have only two joints. The form and proportions of the different parts of the body are well shown in fig. 4. The colour was leaf-green, marked with purplish-brown, which changed to olive-green on the extremities of the limbs and antennæ. The dorsal "stink-glands" were rendered conspicuous by their prominence and dark colour.

The larvæ were sluggish, but they fed readily on the juices of various leaves, standing with their rostra vertically inserted into the vascular parts of the leaves, generally into the midrib. Their abdomens rapidly became almost globular.

During the night between August 21st and 22nd, the first ecdysis took place. A remarkable change both in structure and demeanour was at once apparent. The larvæ

were now about 7 mm. in length, but some individuals were distinctly larger than others. The abdomen had become narrower in proportion to its length; the separation between it and the thorax was now less marked; a raised Y-shaped area had appeared on the dorsal surface of the head; a third joint to the tarsus was feebly indicated (less feebly on the third pair of legs than on the first and second), and the darker markings on the body had become more extensive. The most notable change, however, was in the antennæ. The first and second joints had lengthened very considerably; the penultimate joint had become broad and flat, with a longitudinal ridge on its dorsal surface; the distal, increasing little in actual dimensions, was now pear-shaped. The expansion of the penultimate joint was rendered more conspicuous by the pale colour of the distal adding a purplish suffusion on its own distal half.

In the first instar, then, the antennæ were of a generalized type; in the second they had become highly specialized.

After the ecdysis the demeanour of the larvæ became much less sluggish. They ran about continually, agitating their antennæ, which were not held in the same attitude as in the first instar (compare figs. 4 and 5). They refused, however, to feed on the juices of leaves, and consequently died, in the course of a few days, of starvation.

I have already noted that the individuals differed from one another in size. With the exception of one, which died immediately after getting rid of its old skin, the larger individuals succumbed after the smaller. The difference I attribute not directly to innate physical characters but to the fact that on hatching all the young larvæ did not show the same aptitude in finding the leaves provided for their food. Some wandered about for several hours without settling down to suck, while others commenced to do so at once. All, however, apparently underwent ecdysis at the same time. I may mention that when the skin was cast the expanded joint of the antennæ was drawn out through the narrow aperture at the base of the organ, just as the claws of crabs are drawn out or the expansions on the femora of some Mantodea (e.g. *Hymenopus bicornis*).

As regards the systematic position of these Heteroptera, I have no hesitation in assigning them to be Coreidæ, and very little to the genus *Dalader*, which is remarkable for having antennæ with an expanded, ridged penultimate

joint and a pale-coloured, pear-shaped distal one. If this attribution is correct the species is almost certainly *Dalader acuticosta*, Amyot et Serv., as this is the only representative of the genus known from Lower Bengal, where it is not uncommon.

II.

On August 20th I found seven more eggs of the same species attached directly to the bark of the same tree at Alipur. A few days later I dissected six of them. Each was occupied by a small, black Hymenopteron, already fully formed but enveloped in a delicate membrane. It lay on its belly in the egg, with its head bent down beneath the level of its thorax. The anterior edge of the thorax was directed towards the operculum but was not in contact with it. A sub-triangular, whitish mass covered the dorsal surface of the abdomen, but was not in organic connection with it. Possibly this was all that remained of the proper occupant of the egg-shell which the Hymenopteron had devoured. A similar parasite was hatched from the seventh egg but unfortunately escaped.

In the collection of the Indian Museum I have recently come across a third clutch of eggs, attached to the leaf of a sugar cane. With them are the Hymenoptera bred from them, evidently belonging to the same species. By a very natural error the egg-shells are entered in the Museum register as being the cocoons of the parasite.

I do not know of any other case in which a Hymenopteron has been recorded as parasitic on the eggs of a Heteropteron, though other members of the same family are known to infest the egg-cases of cockroaches. The eggs of the species under consideration are probably very minute indeed and may be introduced through one of the micropyles. No other aperture could be detected in parasitized eggs. It is evident that the shells are firm when the infested eggs are laid, as their base does not preserve a cast of the surface to which they adhere.

The specimens of the parasite examined are in a poor state of preservation. They belong to the family *Chalcididæ* in its wider application: further it would be ridiculous for one who is not a specialist in the group to go.

Explanation of Plate VIII.

Fig. 1. Parasitized Egg of Heteropteron (? *Dalader acuticosta*), from above.

2. „ „ „ „ „ from one side.

3. Egg from which Heteropteron has hatched.

4. Larva in 1st instar.

5. „ „ 2nd „

Figs. 1 to 3 × 8; fig. 4 × 4; fig. 5 × 3.

In fig. 5 the artist has tipped the head of the insect up slightly so that the proximal extremity of the mouth parts appears.

VI. *Notes on the Butterflies observed in a tour through India and Ceylon*, 1903–4. By G. B. Longstaff, M.D., Oxon.

[Read December 7th, 1904.]

INTRODUCTORY.

What follows is an account of the entomological experiences of a "globe-trotter," that is, of a traveller whose main object was to take an all too rapid glance at the scenery, the peoples, and the architecture of the places visited, and whose route was planned with that object. That I was able to give so much time to collecting was due to the fact that, whereas my daughter and her companion felt the heat so much that they usually kept within doors from about 10 a.m. to 3 p.m., I, for my part, protected by a "sola tope" of the "pigsticker" type, and a spinal pad to my coat, suffered no serious inconvenience from the sun's rays *so long as I took active exercise.*

I sailed from England in September 1903 without the slightest intention of collecting, and started accordingly with no entomological outfit save half-a-dozen pill-boxes. Not only was I without net and killing-bottle, I was without books, and worse still, was in woeful ignorance of the Rhopalocera of the Oriental Region.

The day after landing we took train for Simla, and a little south of Jhansi I was struck by the large numbers of bright yellow butterflies along the railway banks—in all probability *Terias hecabe*, L. October 5th found us at Kálka, at the foot of "The Hills." Fortunately the new railway was not yet open, so we had to be driven up the 58 miles to Simla in a "tonga," or post-cart, by a wild-looking hillman who handled the ponies magnificently. To one fresh from Europe the sights on the road were truly marvellous: long trains of wagons drawn by humped oxen or by buffaloes; natives in divers strange costumes, or lack of costume; flocks of goats and herds of cattle; strings of pack-mules, and, to crown all, long lines of solemn camels, always hideous, yet always picturesque. However, amid all these strange sights there was one other which

interested me if possible even more, I mean the multitude, the variety, and above all the beauty of the butterflies. The first sight of such a thing as the big *Hypolimnas bolina*, L., black flashing with violet-blue, excited an emotion better imagined than described. At all events, the creatures took me fairly by storm: collect I must!

The resources of the bazár at Simla only produced a child's butterfly-net, a mere toy, scarce twelve inches in diameter and of a pale yellow colour! Armed with this and a tin cigarette-box filled with triangular envelopes I took the field. To this scanty equipment was shortly added a cyanide bottle. It was two months before the toy-net was superseded by an umbrella-net from Watkins and Doncaster. This last is a very convenient weapon for use in towns, or when travelling or sight-seeing. It is inconspicuous when rolled up, but can be quickly brought into action; it is however inadequate for serious work. In Calcutta I purchased a large Y-net with jointed canes, and had it fitted to the end of a landing-net stick that was made in two pieces that were six feet long when joined. A fair-sized net is required for large and swift butterflies, while for the many that habitually fly high and settle far from the ground, six feet is none too long a stick, though in narrow woodland paths it will be found unwieldy. Another time I should travel with a jointed stick of three segments, each three feet long. I may here add that mosquito netting is far more serviceable than leno, owing to its superior power of resistance to thorns of all sorts.

Mr. Otto Möller, of Darjiling, told me that he found it best to pinch all butterflies, even the smallest, but I found that Blues and Skippers were best "bottled." No doubt it would have been better to pin many moths, but my things were all enveloped in the way usual for butterflies, and the dates, localities, and any remarks that suggested themselves were inscribed upon the papers. [These data are still attached to the specimens.] Since getting back to England the insects have been serially numbered, and the data copied into a note-book. On another journey I should number the insects at the time, and while putting the more important data on the papers as before, copy these, amplified where necessary, into a book. This would, I am quite sure, save much time and result in a more complete record.

The insects were sent to England from time to time

by parcel post in small cigar-boxes, each enclosing a ball of naphthalene. In no case do they appear to have sustained any injury on the way. They have been beautifully set at Oxford by Mr. A. H. Hamm, and all that are worth preserving will be placed in the Hope Collection, while the explanatory note-book will be deposited in the library of the Department.

The total number of specimens sent home was as follows :—

	All countries.	*India and Ceylon only.*
Butterflies	1867	1494
Moths	206	125
Coleoptera	21	15
Hymenoptera	27	27
Neuroptera	15	5
Diptera	5	5
Hemiptera	10	8
Orthoptera	13	13
	2164	1692

In round numbers, I was five months in India and three weeks in Ceylon—say, six months together; during this time I took nearly 1700 specimens, of which 1500 were butterflies belonging to 204 species.

To these may be added the results of a fortnight in China, a month in Japan, and a fortnight in Canada, viz. 500 more specimens, and 64 additional species of butterflies, which are only incidentally alluded to at the end of this paper.

Naturally in a rapid tour of this kind there is small probability of turning up anything new, but it is hoped that some of the observations made (even on the commonest species) may throw a glimmer of light on some of those questions of Bionomics which are now attracting attention.

Simla, lat. 31° N., alt. 7200 ft.

In reference to the seasonal variation of many species it may be remarked that at Bombay on October 2nd and 3rd there was heavy rain, the tail-end of the monsoon. It was held to be a very late season, the rain had lingered and the cold weather was delayed.

My collecting at Simla was confined to a riding expedition along the old Hindustan-Tibet road. This is an

excellent riding-path along the watershed of the Sutlej and Jumna, cut at one time on the hot and dusty southern side of the mighty ridge, where the terraced slopes are covered with crops of maize, or ruddy millet; anon crossing to the northern side which is mostly clothed with fine forest of spruce, deodar, holm-oak and rhododendron—thus winding in and out, but for the 50 miles that we traversed always maintaining an altitude of from 7000 to 9000 ft. We went by way of Fágu, Theog, Matiána and Narkanda to Bághi, returning by the same route, except that from Bághi to Narkanda we walked over Mt. Huttú, 11,000 ft.* The expedition occupied eight days, but for simplicity of description I shall not distinguish between outward and return journeys.

The general aspect was decidedly autumnal; the nights were chilly and most flowers had gone to seed. There was more cloud than usual, and there were occasional slight thunder-showers. Most of the butterflies seen appeared to have been out some time, and were much battered. Two circumstances tended to restrict the bag—one, the fact that collecting was for the most part confined to a narrow mountain road, bounded by a precipice on the lower, and a cliff upon the higher side; the other, a limitation of wide application, that a tropical sun is not conducive to rapid pursuit.

Simla, alt. 7200 ft., to *Fágu*, alt. 8200 ft.

October 10th and 17th.

Gonepteryx rhamni, L., var. *nipalensis*, Dbl., was abundant throughout the journey, and so was *Aulocera swaha*, Koll., though in very poor condition; both occurred in Simla itself. The last named is a Satyrid having on the upper-side a resemblance to our White Admiral, flying also with much of the grace of that favourite butterfly. It loves open spaces in woods, returning to the same spot when disturbed. When it settles on the ground, a rock, a flower, or a tree trunk, it often goes over on one side as much as 45° or even 50°. I saw one of these butterflies make three successive efforts, getting further over each time! On two distinct occasions I watched a butterfly settle twice, turning the first time over to the

* In Indian names "á" is pronounced as "a" in father, "ú" as "oo" in boot, "a" or "u" as "u" in but.

right, the second time to the left. I think there is no doubt that this "list" makes the insect less conspicuous.

Pararge schakra, Koll., is another common roadside butterfly in the Simla district; it closely resembles our *P. megæra*, L., but is larger. *Chrysophanus phlæas*, L., var. *timeus*, Cr., was also common; *Colias fieldii*, Mén., is sufficiently like our *C. edusa* to readily pass for that species; *Polyommatus bæticus*, L., is also suggestive of our South Downs, where it has been seen; the same may be said of *Argynnis lathonia*, L. Again, *Pyrameis indica*, Herbst., is very like our *P. atalanta*, L., though not so handsome and scarcely as graceful in its movements. So far there was plenty to bring to mind the fact that one was still within the Palæarctic Region. There were however a few insects to suggest the close proximity of the great Oriental Region, for if *Atella phalanta*, Dru., is very like a Fritillary (at least on the upper-side), and *Ilerda sena*, Koll., closely resembles a Hairstreak, on the other hand, the under-side of *Belenois mesentina*, Cr., is decidedly more brilliant than our Whites, while there is no denying that *Precis orithyia*, L., is quite Oriental in its aspect. This insect had struck me with admiration at Solon on the way up to Simla, and is called by the school-boys of India's summer capital, "The Ladies' Fancy." With the habits of a *Vanessa* or *Pyrameis*, there is something about the shape of the wings, the prominent ocelli, the brilliant blue of the hind-wings, and the leaf-like colouring of the under-side which gives it a very "tropical" appearance. However, one soon learned to look upon it as one of the most familiar butterflies of Northern India. At Fágu it was common, but like most butterflies which have a proclivity for settling on the ground, not too easy to catch.

At Fágu another butterfly of European aspect was common, *Vanessa kashmirensis*, Koll.; this is no credit to its name, but looks like an *urticæ*, L., that had been born and bred in the "Black country." But the Chalcosiine day-flying moth, *Agalope hyalina*, Koll., elegant in shape and quiet in colour, white, shaded with grey towards the tips, ochreous at the base, was quite a stranger.

Fágu, 8200 ft., to *Theog*, 7400 ft.

October 11th and 16th.

Before our start in the morning I found abundance of *Chrysophanus pavana*, Koll., in dry weedy corners of

cultivated ground; this is sufficiently distinct from *C. phlæas*, but has no especial oriental glamour.

From the ground by the roadside I picked up a large newly-emerged Bombyx with the awe-striking name of *Trabala vishnu*, Lefevre; it was unfortunately a good deal damaged in the killing, through having no oxalic acid available. Two Blues, *Cyaniris vardhana*, Moore, and *Zizera maha*, Koll., var. *diluta*, Feld., together with the Hairstreak, *Ilerda sena*, completed the bag for this stage.

Theog, 7400 ft., to *Matiána*, 7700 ft.

October 11th and 16th.

At Theog, our first halting-place, *Goncpteryx rhamni*, var. *nipalensis*, was especially common, and here I took my first *Athyma opalina*, Koll., a Vanessid resembling on both upper and lower surfaces *Limenitis sibylla*, L., an insect to which it is closely allied in structure and habits.

On the road, besides *Ilerda sena*, *Chrysophanus pavana*, *Precis orithyia*, and *Argynnis lathonia*, var. *issæa*, Moore, several things turned up. Of *Pyrameis cardui*, L., a fresh brood appeared to have emerged on the 15th or 16th October, and was common at the flowers of a straw-coloured thistle. I saw a few more *Athyma opalina*, and secured one. In their elegant floating flight one seems to see through the white markings of the butterflies of this genus. The Simla school-boys call them "Sailors," but to me the name "Ghosts" would seem more appropriate. They settle on the leaves of trees or shrubs, rarely affecting flowers. Here I got my first *Precis lemonias*, L., an insect with the habits (and structure) of a Vanessid, but with much the appearance of *Pararge ægeria*, L. A specimen of *Terias libythea*, F., taken on the return journey, bears the note "easy to catch," which is true, but at the time I do not think that I distinguished it from the much commoner *T. hecabe*, which it closely resembles.

At Matiána I found *Chrysophanus phlæas*, var. *timeus*; *Vanessa kashmirensis*; *Precis orithyia*; and two specimens of *Huphina nerissa*, F., both males. This last is a somewhat glorified *P. napi*, L.; one of them appeared to have a slight scent which I could not describe, but certainly it was not that of the male *napi*.

Perhaps the most abundant butterfly at Matiána, and indeed throughout the woods of the district, was *Cyaniris*

singalensis, Moore, very like our *argiolus*; it was in poor condition, flying about the tops of tall shrubs, but not seeming to affect either ivy or holly, although both were there.

Pararge schakra was especially abundant at Matiána and on the road thence to Narkanda. It differs from our *P. megæra*, L., in being larger and having more striking ocelli, though these are variable, one of my specimens, a female, having the ocellus near the tip of the fore-wing far larger than the rest. In its habits this insect sometimes reminds one of *P. megæra*, sometimes of *Satyrus semele*, L. It abounds along roads and in bare places, alighting almost always on the earth or on rocks, with its wings expanded (as with *megæra*), but when it settles down to rest the wings are raised, the fore-wings drawn back within the hind-wings, all that remains visible being the colour of dust. In no case did I see it turn on one side as *S. semele* does, but three times I observed it settle with its back to the sun, so as to reduce its shadow to a mere line; unfortunately I made this observation towards the end of my acquaintance with the butterfly, so was unable to make sure whether this was a mere chance or a definite habit. At any rate, I did not observe any instances to the contrary. I suspected in *P. schakra* the existence of a very slight sweet scent, that appeared to be unlike that of any other species.

At Matiána I beat out of alders a number of geometers, three *Philereme variegata*, Warr., and one *Cidaria niphonica*, Butl.; they had a jerky flight, which saved many of them from capture. A Deltoid, *Hypena tristalis*, Leder., came to light at night.

Matiána, 7700 ft., to *Narkanda*, 8800 ft.

October 12th and 15th.

Many of the same insects were met with as on the previous stage, but the following may be noted: *Terias hecabe*, my first specimen of the commonest species of a very characteristic Indian genus; *Ganoris canidia*, Sparrm., a White like *P. rapæ*, L., but with bigger black spots; and *Belenois mesentina*, flying fast and going straight ahead in a purposeful manner. Here I may remark that the swift flight of the Whites generally has much impressed me; it is evidently closely related to the fact that they are

quite the most conspicuous of all butterflies, especially at a distance. *Argynnis lathonia*, var. *issæa*, was again well to the front; another *Athyma opalina* was securely "papered," and a specimen of *Precis lemonias* was taken in which the anal angle of both hind-wings had been bitten off nearly symmetrically. Amongst many of the *argiolus*-like *Cyaniris singalensis*, Moore, one *C. vardhana*, Moore, was taken; also *Chrysophanus pavana*. Three geometers, *Philereme variegata*, Warr., *Docirava æquilineata*, Walk., and the widely-distributed *Polyphasia truncata*, Hufn. (*immanata*, Haw.), complete the list.

At Narkanda *Argynnis lathonia*, var. *issæa*, was in great numbers in the woods, so was the Chalcosiine moth *Agalope hyalina*; this flies fast and always in the same direction, in this case up-hill and against the wind, more especially up certain gorges in the mountain side. It was hard to catch, and on the wing looked much larger than it is, but on settling vanished suddenly, burying itself in the herbage.

Colias fieldii was common, but was not remarkable for swift flight. *Terias hecabe* was also to be seen.

Narkanda, 8800 ft., to *Bághi*, 8900 ft.

October 13th.

The road through the magnificent forest, whence gaps in the towering spruces give inspiring glimpses of "The Snows" lying far away across the deep valley of the Sutlej, was at this season too dark and chilly to be the haunt of butterflies. At Bághi were *Atella phalanta*, *Neptis astola*, Moore, worn specimens of *Aulocera swaha*, and *Agalope hyalina*.

Bághi, 8900 ft., over *Mt. Huttú*, 11,000 ft., to *Narkanda*, 8800 ft.

October 14th.

Bághi, our furthest point, is but 26 miles W.N.W. of Simla, though by the winding mountain road it is fifty. The steep footpath up Mt. Huttú, when it has attained an elevation of a little more than 10,000 ft., emerges from the forest on to a flowery clearing that bore evidence of former cultivation. Here I saw *Colias fieldii*, *Atella phalanta*,

and *Argynnis lathonia*, and here I took two specimens of *Parnassius hardwickii*, Gray, one worn, the other in beautiful condition; it is a lovely creature, but the under-side has a curious resemblance to oiled paper. Delicate looking though it be, it is strangely tenacious of life. The concurrence of a "Clouded Yellow," a "Queen of Spain," and an "Apollo" was very suggestive of the Alps. All too soon the path plunged again into the now somewhat scrubby forest to come out finally, at near 11,000 ft., on to the grassy, flower-bedecked plateau in which the mountain culminates.

The Lha To, or rude altar of the degraded form of Buddhism that is prevalent in "The Hills," crowning the highest peak, reminded one of the High Places of Baal. The troops of butterflies seemed almost to rejoice in the glorious panorama of "The Snows" spread far around. The brilliant *Argynnis lathonia* was common, and the dingy *Vanessa kashmirensis* quite abundant—probably the more distant of yon white peaks to the left arises from its name-place, Kashmir. *Colias fieldii* was also in large numbers, a female exhibiting a symmetrical injury to the hind-wings very suggestive of a peck by a bird. *Precis orithyia* was there too, but *Auloccra swaha* was conspicuous by its absence. Of a humming-bird moth, much smaller than ours, *Rhopalopsyche nycteris*, Koll., I netted three specimens, one at the flowers of a delphinium. *Herbula cespitalis*, Schiff., reminded me of home. The Blues were represented by *Cyaniris singalensis*, Moore. A male *Terias hecabe* was of the wet-season form. I noted that this species is very easy to catch, and is brilliant on the wing; also that when settled on a shrub or flower it is usually extremely conspicuous, but not so when it chooses as its resting-place a certain low plant with oval leaves fading to a yellow tint; then the rounded form of the wings greatly aids its concealment. An old friend, *Euxoa corticea*, Schiff., was taken flying in the sunshine. I had several exciting chases after a big yellow Swallow-tail, and eventually secured one—my first *Papilio*! It proved to be our *machaon*, L., var. *asiatica*, Mén. Here, as in Japan, it scorns fens and dykes, glorying in mountain tops.

On the way down to Narkanda several *Pyrameis indica* disputed the path with our party.

The great resemblance to European forms presented by the bulk of the butterflies seen in this expedition cannot fail to strike the reader.

Solon, circa 5000 ft., to *Kálka*, 2184 ft.

October 20th, 1903.

Starting from Simla by starlight, soon after 5 a.m., we got to Solon by breakfast-time, and I there caught at 9 a.m. my first butterflies, two *alsus*-like Blues, *Zizera karsandra*, Moore, and *Z. maha*, Koll. Also two flies, a *Musca* of the *domestica*, L., group, and an Anthomyid.

On the drive from Solon to Kálka, by making the most of stoppages to change horses, and by occasionally jumping out of the carriage, I managed to secure quite a lot of things. Among the commonest was the beautiful *Precis œnone*, L., and with it *P. orithyia* and *P. lemonias*. Of *Atella phalanta*, *Belenois mesentina*, ♀, and *Ilerda sena*, I took single examples. *Terias læta*, Boisd., was rather common. There were also *Catopsilia pyranthe*, L., the *gnoma*-form, *Terias hecabe*, and *Huphina nerissa*. About two miles above Kálka, say at about 2700 ft., I got a single *Precis iphita*, Cr. At about the same place the great catch of the morning was made, for I took my first *Hypolimnas bolina*, three males and a female, believing them at the time to be two species. Why does not this glorious insect retain its far more poetical and more appropriate name, *Diadema jacintha*? Surely a black butterfly 3½ inches in expanse with four large glancing-blue spots, one on either wing, deserves to be called after a gem. Anyway, I shall never forget the impression produced by my first sight of its truly oriental splendour; it was like Kingsley's "At last!"

On my way down I also saw *Pyrameis indica*, and missed two Papilios, probably *P. machaon*.

At Kálka I got an hour and a half's collecting late in the afternoon; it was partly on waste ground about the station, but mainly in a field bearing a crop of some kind of pulse with thin pods 4–5 inches long.

A black and brown Cantharid beetle, *Mylabris sidæ*, Fab., was flying about flowers in the sunshine in large numbers. The genus *Precis* was represented by *orithyia* and *œnone*; the genus *Terias* by *hecabe*, *læta*, and quite a number of *libythea*. The inevitable *Atella phalanta*, never very common, and *Belenois mesentina* were to the front again. *Ganoris canidia* was fairly common; I noted that a male had a "snuffy scent." Single specimens of *Ixias marianne*, Cr., and *Huphina nerissa*, both males, were taken. Of *Cato-*

psilia pyranthe I took two females, one of which had suffered a symmetrical injury to both hind-wings. Three or four *Hypolimnas bolina*, both sexes, were disturbed in their first sleep, and being drowsy fell an easy prey. The Blues were represented by several species—*Zizera maha*, Koll.; *Z. otis*, Fab., var. *indica*, Murray; *Catochrysops cnejus*, Fab.; and *Nacaduba noreia*, Feld. Two Pyrales, *Hymenia recurvalis*, F., and *Bradina admixtalis*, Walk., and a worn Acidalid were picked up. A Sphinx, *Nephele hespera*, Fab., was taken during the afternoon at the flowers of a *Bryonia*. A little later on, an Arctiid moth, *Artaxa lunata*, Walk., came to the lamp of the railway carriage, to which a Sphinx, probably another *N. hespera*, also paid a momentary visit.

Peshâwar, lat. 34° N., alt. 1165 ft.

October 22nd—25th, 1903.

This city is finely situated in the extreme north-west of the great plain of the Panjáb, or Five Rivers; the mountains of the Sufid Koh and the foot-hills of the Hindú Kúsh bounding the view to the west and north respectively.

In the hotel garden I took a few things; *Terias hecabe* was common, two of them lacked "the dog's head mark." *Belenois mesentina* was represented by a solitary male. One of three males of *Ganoris canidia* yielded a decided scent, hard to describe but certainly not that of *G. napi*. That dingy Skipper *Parnara mathias*, Fab., was abundant at the flowers of Duranta. I missed several specimens of a yellow *Papilio*, probably *erithonius*, Cr., and I believe one allied to *podalirius*, L. Of the Blues I took one *Polyommatus bæticus*, and three *Zizera karsandra*, Moore.

Two moths came to light, *Oligochroa akbarella*, Rag., and *Earias tristrigosa*, Butl.

Near the waterworks at Bára, amidst a wilderness of stones, I netted a female *Belenois mesentina*, three Blues, *Tarucus theophrastus*, Fab. (2 ♂, 1 ♀), and my first *Teracolus*, a female *etrida*, Boisd. Dr. Dixey tells me that he had no idea that this species ranged so far north. A strange-looking grasshopper, *Truxalis nasuta*, L., seemed well adapted to its stony desert surroundings.

From Peshâwar my most interesting expedition, from every point of view, was to Ali Musjid in the Khaibar Pass. This tiny white building, said to be the first

Musjid erected in India by the invading hordes of Muhammadan conquerors, stands about 2400 ft. above sea level. Close to flows a little stream full of fish and frogs, which produces an oasis among the hot dry rocks, where large beds of a species of mint attracted a number of butterflies, which I pursued under the strict and curious supervision of those good-natured barbarians, the Afridis of the Khaibar Rifles, who twice a week safeguard the caravans as far as Lundi Kotal.

Limnas chrysippus, L., was fairly common. I took two males and two females, one of the latter with pale ground-colour of an umbreous tint and much shading along the costa. *Pyrameis cardui* was the commonest butterfly, mostly in fine condition. I took one *Ganoris brassicæ*, L., of the form *nipalensis*, Gray, a female, and saw several *G. canidia*, which had all possibly strayed from a patch of cultivated ground hard by. The Clouded Yellows were represented by several *Colias hyale*, form *crate*, Esp. The beautiful *Precis orithyia* was quite abundant; *P. almana*, L., also occurred, but was not common. I saw several *Terias hecabe*. The Satyrids were the most interesting of all. A specimen of *Yphthima balanica*, March, was my first acquaintance in that elegant and delicately-made genus. *Satyrus parisatis*, Koll., a handsome insect suggestive of *Vanessa antiopa*, L., was rather common, but unfortunately much worn. Very conspicuous on the wing it did not appear to be attracted by the mint, but usually settled on the ground, and was then very difficult to see. I also secured two specimens of a very distinct pale Satyrid, much the colour of *C. pamphilus*, L., but much larger and with dentate hind-wings, *Epinephele davendra*, Moore; they were both ♀. I took two *Polyommatus bæticus*, but saw no Skippers.

Three of that widely-distributed beauty, *Deiopeia pulchella*, L., were seen flying in the sun, and with them a brilliant little Burnet, *Zygæna kashmirensis*, Koll.

Among the outsiders were a locust, *Pœciloceera picta*; a beetle, *Clinteria confinis*, Hope; two bees, *Bombus similimus*, Smith, ♂ and ♀; and a wasp, *Vespa auraria*, Smith (☿).

Malakand, lat. 34° 30′ N., alt. circa 3000 ft.

October 28th and 29th, 1903.

By the kind hospitality of the Political Officer, Capt. R. W. E. Knollys, I was enabled to get two days' collect-

ing at this remote frontier post. Perched on a saddle, where the old Buddhist road crosses the foot-hills, looking forward over the Swat valley, back over the dusty plain of the Panjáb, this isolated fortress affords a picture of rocky desolation. The Pass is closed every night by *chevaux de frise*, and the garrison is always prepared for attack. When I went collecting it was deemed prudent that I should be accompanied by a gigantic *chuprassi*, a Pathan of the tribe of the Jusufsai, or Sons of Joseph. Moreover, when scrambling over the hillsides, in addition to the usual Indian thorns in all their varieties, wire entanglements have to be negotiated!

The rocky hills seemed too dry and burnt up to harbour many butterflies, but on the parched slopes of the fortified crag, nicknamed Gibraltar, the pretty little *Melitæa trivia*, Schiff., was almost abundant; on a glaucous shrub at the foot of the same hill were numbers of a glaucous green and yellow locust, *Pœciloceva picta*, which though conspicuous enough on the wing was decidedly cryptic. Other Ornithoptera were *Quiroguesia blanchardianus*, Sauss., and *Truxalis nasuta*, L. I also took three wasps, two *Vespa velutina*, Lep. (var. "*des Indes*," Sauss.) ♂, and a ♀ *Polistes hebræus*, F.

In addition to the above a long and hot walk only yielded one *Ganoris canidia*, ♂; two *Terias hecabe*, a ♂ of the variety without the "dog's head," and a large but otherwise normal ♀; two Blues, a *Zizera karsandra*, Moore, and a *Z. maha*, Koll., var. *diluta*, Feld.; one *Precis orithyia*; a dingy Skipper, *Gegenes nostrodamus*, Fab., and a micro, *Tinægeria*, sp. Some puddles of water at the baggage-mules' drinking-place proved very attractive, yielding *Argynnis niphe*, a ♀, *Tarucus theophrastus*, F., a ♂, and the conspicuous *Hipparchia parisatis*.

The next day (Oct. 29th) I lighted upon an oasis in the desert in the shape of the staff-sergeant's garden, where irrigation had produced a brilliant mass of flowers, some vegetables, and a small field of lucerne. Here butterflies abounded: *Terias hecabe*, without the "dog's head mark," was in plenty among the lucerne as well as at the marigolds; the lucerne also yielded both *Colias fieldii* and *C. erate*, the eastern form of *hyale*. Among the Danaids *Limnas chrysippus* was common, and *D. genutia*, Cr., abundant at the marigold flowers, at which also one *Tirumala limniace*, Cr., was taken. *Athyma perius*, Linn., was rather com-

mon, but preferred the wet mud left in the irrigation channels to any flowers. *Argynnis niphe* was also common, but had more refined taste, and was usually taken on the marigold beds; its female was observed during life to resemble *L. genutia*. *Precis almana* was common; *P. orithyia* very abundant at the same flowers, together with a few *P. œnone*, one of them very fine and large. As usual in India *Atella phalanta* and *Belenois mesentina* put in an appearance, the first at marigold, the second (a ♂) among the lucerne. The Hairstreak *Ilerda sena* occurred alike at marigold and high up on the mountain-side. The flowers of *Gaillardia* proved more attractive to the smaller fry than the coarser marigolds; the brown Skipper, *Parnara mathias*, Fab., was in abundance, so were the dingy Blues, *Zizera karsandra*, Moore, and *Z. maha*, Koll., but the latter and its variety *diluta*, Feld., preferred mud to any flowers.

Other small things were *Polyommatus bæticus*, and the Skipper *Gegenes nostrodamus*, Fab., which was common at the flowers of *Gaillardia* and marigold. I saw this species at Malakand only, and unfortunately secured but two specimens. Two or three *Melitæa trivia* also turned up at these favourite flowers. Not far from the garden I took two more *Hipparchia parisatis*; this does not appear to be much attracted by flowers, but settles on the ground and is then often very hard to see. I observed it lean over from 20° to 30°, and even saw it walking about with a "list" of 20°.

Lahore, lat. 31° 35′ N., alt. circa 700 ft.

October 31st—November 4th.

At the capital of the Panjáb, a city of the plains, my chief collecting ground was the extensive Lawrence Garden, which though full of flowers is, in parts, so wild that, not to mention a mongoose, I even came across a jackal at midday. The class of butterflies found here differed widely from those met with at Simla and further north, the predominant forms being Oriental. Here I first captured *Papilio crithonius*, Cr., the "tailless swallow-tail," which I had perhaps seen at Pesháwar; this butterfly has a wide range in India and might almost be termed abundant, it especially frequents the flowers of *Zinnia*,

Lantana, and *Bougainvillea*. When feeding it settles for a few moments only, fluttering with its wings the while; then it is not hard to catch, but when rushing from place to place it is far otherwise. In colouring it is very like *P. machaon*, but far less handsome; the yellow ground-colour is often quite pale and bright when the insect is fresh, but it usually turns much darker and duller; I suspect that cyanide hastens this process. At Lahore also I first came across another very common Indian butterfly, *Papilio pammon*, L.; its graceful form and flight and rich velvety-black coat at first excited me so much that I had great difficulty in catching it! Naturally enough I followed Linnæus in taking the sexes for different species: he called the male *pammon*, and the very different female, Wallace's second form, *polytes*. At Lahore it especially affected the flowers of *Bougainvillea* and a shrub with blossoms like in colour and scent to, but much larger than, those of white jasmine. Like *P. crithonius* it flew rapidly from flower to flower and fluttered while feeding. The female taken here was of Wallace's second form (*polytes*); among the males was a dingy variety with scarcely any orange on the under-side of the hind-wings.

Limnas chrysippus was abundant, more especially at the flowers of *Asclepias* (the food-plant); amongst them was a dwarf female. *Tirumala limniace* was scarcely common.

Of *Catopsilia pomona*, F., I only netted one female, but believe I saw others; it visits flowers high up on trees. *C. pyranthe* was abundant; it flies fast and high and is hard to catch: it was fond of settling on the flowers of duranta on the tops of high hedges, forming a pretty contrast with the lilac-blue racemes.

Terias hecabe, both sexes, was fairly common; it flew slowly and near the ground. The black and white *Teracolus puellaris*, Butl., was also fairly common; perhaps it owes its name to the child-like simplicity of its dress. It flies near the ground, but so jerkily as to be somewhat hard to catch. It has the habit of flying *into* bushes, by preference those well provided with thorns, and not coming out again. Of *T. protractus*, Butl., I could only get two specimens; its salmon-pink colour with broad black margins dusted with blue-grey make it one of the most beautiful little butterflies that I came across; its dress is all in exquisite taste, the under-side being a quiet greenish-yellow that must greatly protect it when at rest.

White butterflies were not much in evidence; I took a somewhat worn female of *Appias libythea*, Fab., also two *Belenois mesentina*, both females. This last is another common Indian butterfly; its upper surface reminds one of *P. daplidice*, L., but beneath the hind-wings and tips of the fore-wings are bright orange with brownish veins. Experience at Lahore confirmed me in the opinion that "Whites" of all sorts are most difficult to catch; they are shy, and fly rapidly with a jerky vertical movement. "Whites" are by far the most conspicuous butterflies, especially when at a distance, and doubtless they need their swift wings. The Catopsilias are nearly as conspicuous as the true Whites, and they fly even more swiftly.

Among the Nymphalids the widespread *Atella phalanta* was represented by a few specimens at marigold flowers. *Precis orithyia* (an insect that suffers much loss of beauty from grease) was not common, the same is true of *P. almana*; a few of each were taken at flowers. At zinnia flowers I got my first *Hypolimnas misippus*, L., a male; it impressed me as a most tropical-looking insect, though not so gorgeous as *H. bolina*; it had both hind-wings clipped, possibly by a bird.

The Blues were represented by two species—the neatly-marked *Tarucus telicanus*, Lang., common at the flowers of *Plumbago*, and the little greyish-blue *Zizera maha*, Koll, abundant at the flowers of a species of millet and some herbs of the labiate family; amongst them was a specimen of the var. *diluta*, Feld. Blues swarm in India, many of the species are small and dingy, so that they are hard to follow on the wing, and their flight is even more jerky than that of Whites. They are often found on grassy banks as at home, but are especially addicted to water-drinking and are constantly present in irrigated fields and gardens. It must be confessed that the abundance of bigger game often led one to pass them by. Blues when killed are apt to fold their wings the wrong way, and it is difficult to set them right; but if only kept a short time in the bottle with a view to preventing this untoward result, they are apt to recover and fly away when the paper is opened after the day's work.

The dull-coloured Skipper *Gegenes nostrodamus*, Fab., was common in the gardens, but I only took one female. Small moths, especially Pyrales, were abundant in a patch of long grass and herbage in a damp spot. One of these

was *Pyrausta incoloralis*, Guen., another the tiny Gold-tail, *Porthesia marginalis*, Wk., which was flying in the sun. There was also the very widely-distributed *Marasmia trapezalis*, Guen.; but by far the commonest was the pretty little black-and-white *Hymenia recurvalis*, Fab. (very suggestive of our *E. cingulalis*, L.).

In the gardens of the Shah Dara, Jehangir's mausoleum, four miles from Lahore, I saw at dusk a number of Hawk-moths at the yellow tubular flowers of a small tree. My short-handled net only allowed me to catch two, which proved to be beautiful specimens of *Nephele hespera*, Fab., and *Chærocampa celerio*, L.

In writing to Dr. Dixey from Lahore I made the suggestive remark: "It is evident that being late in the autumn many of the butterflies are old and much worn. Curiously enough they are more often tattered and torn than actually rubbed." It is difficult to rightly apportion the breaking of the wings between the work of thorns and insectivorous foes. Certainly Indian butterflies fly into and through bushes in a way that one does not see at home.

In the Ajáib Ghar, or Wonder House of Lahore, Anglicé Museum, well known to readers of "Kim," is a small collection of insects. This was useful to me, but the destruction wrought by *Dermestes*, etc., both among the insects and the textile fabrics of the Industrial Collection, is most sad to see. I trust Mr. Kipling will see to it.

Amritzar, lat. 31° 40′ N., alt. circa 750 ft.

November 5th and 6th, 1903.

At the sacred city of the Sikhs my collecting was practically confined to two gardens close to the hotel. Here a large dull brown butterfly, with somewhat of the *Vanessa* habit, spread itself perfectly flat upon the surface of the earth and more especially of the damp mud of the little irrigation channels, lying so close to the surface as to be with difficulty discerned, so exactly did it resemble the tint of the mud. I secured three which proved to be *Euthalia garuda*, Moore, all females.

Papilio pammon was common; besides males I took one female of Wallace's Form I, which differs but slightly from

the male and is hence termed *pammon pammon*. Of *Precis almana* I took one, of the ubiquitous *Belenois mesentina* likewise one, a female, but I was somewhat surprised to net a *Colias fieldii*, ♀, since the great plain of the Panjáb seemed an unlikely locality for a *Colias*.

Yphthima nareda, Koll., was scarcely common in the hotel garden, it flew close to the ground. The list closes with *Polyommatus bæticus* and a grasshopper to which Mr. Kirby cannot assign a name.

Delhi, lat. 28° 30′ N., alt. circa 700 ft.

November 7th—12th, 1903.

When collecting in the Kudsia Gardens at Delhi it was impossible not to be impressed with the historic associations of the ground. Lying between the northern walls of the city, the famous ridge, and the mighty Jumna, scarcely more than a furlong from John Nicholson's grave, stands, nearly hidden by trees and flowering shrubs, all that is left of the Summer Palace of the kings of Delhi. Its crumbling walls, where not covered by Bougainvilleas or other creepers, bear testimony by many a bullet-mark and round-shot hole how fire-swept the place was during the long hot days of 1857. Concrete blocks with suitable inscriptions mark the sites of the breaching batteries of the last stages of the siege—batteries placed strangely near the walls when measured by the range of modern guns, for yon breach in the Water Bastion is scarce two hundred yards from the most advanced battery!

Here in a beautiful garden, the very ideal of quiet and peace, where the numerous grey-striped squirrels are quite tame and the greenest of parrots and the crested hoopoes look as if war were unknown upon earth—here I watched many gorgeous *Papilio aristolochiæ*, Fab., fluttering upon the flowers, or sailing over the trees; at one moment looking like black *crêpe* against the light, at another displaying a circlet of brilliant rubies beneath. Once I had three together in my net! With these were a few *P. erithonius* and *P. polytes*, the latter females of Form II.

Limnas chrysippus was also common, one, a male, was unusually small. *Crastia core*, Cr., was common in shady places under mango trees, but was rarely seen at flowers. The pretty little black and salmon-coloured *Teracolus*

calais, Cr., was abundant alike in the Kudsia Gardens and close to the hotel, flying near the ground yet not so easy to catch. One of them was very small. Of *T. puellaris* I only saw two. The "wet season" form of *Terias hecabe* was abundant, flying low and about bushes.

Of the brilliant yellow and orange *Ixias pyrene*, L., I took but one; the less gaudy Orange-tip, *I. marianne*, was rather common, but some of them were worn and none very easy to catch. The genus *Catopsilia* was represented by one worn male *pyranthe*, and I took my first *Delias eucharis*, Dru., a very worn female. The common Whites were *Huphina nerissa*, all males, and *Belenois mesentina*, which was abundant at flowers. The slender little *Nychitona xiphia*, Fab., flitted weakly along close to the ground, reminding me irresistibly of *Leucophasia sinapis*, L., in spite of all structural differences. One of these ghostly creatures was taken flying over a tablet that marked the site of "Battery No. IV. Left attack; mortars." One wondered whether there were any butterflies in that place during the terrible summer of 1857.

Three or four *Precis lemonias*, L., appeared to be rather fond of shade, they settled upon the ground in preference to flowers and then were hard to see. Of the gorgeous *Hypolimnas bolina* I saw one of each sex; it needed an effort to believe that they were one species.

The Blues included *Catochrysops cnejus*, Fab.; *Tarucus theophrastus*, Fab.; *Chilades varunana*, Moore; and *Chilades laius*, Cr., this last was common. The only Skipper taken was *Telicota augias*, L.

A little geometer, like a *Macaria*, was common among herbage, *Semiothisa fidoniata*, Guen., and one specimen of *Tephrinia disputaria*, Guen., was taken in like situation. *Semiothisa fidoniata* also came to light, along with *Oligochroa akbarella*, Rag. Can M. Ragonot have intended a deliberate insult to the memory of the great Emperor when he named this dingy and insignificant little Phycid after him?

Other moths taken in the Kudsia Gardens were the tiny Noctuids *Metachrostis badia*, Swinhoe, and *Earias tristriyosa*, Butl., which was common among bushes near a back-water of the Jumna.

In the verandah of the hotel I took a fine *Sphinx orientalis*, Butl., the eastern form of *convolvuli*, L.; it had probably been attracted by the lights the night before.

Lálkot. November 10th.

Eleven miles south of Delhi lies this glorious city of ruins, and there, under the shadow of the Kutb minar, flying over the stones and amidst the thorny vegetation were many Whites and Orange-tips. The butterflies appeared especially to delight in flying about inside the thorniest bushes, or even flying through and through them, so that torn wings were almost the rule. Prominent in the countless crowd of *Belenois mesentina* so employed were *Ixias marianne* and *I. pyrene*; a female of the former was distinguished by the substitution of cream-colour for white in the ground-tint of the wings. The delicate-looking *Teracolus etrida*, lover of ruins, was in abundance, flying close to the ground.

I saw one black *Papilio*, one *Limnas chrysippus* and one *Prœcis lemonias*.

Náini Tál, lat. 29° 30′ N., alt. 6500 ft.

November 16th—23rd, 1903.

Unlike Simla and Darjiling, which stand astride lofty ridges, Náini Tál lies in a basin by a lake, a situation which, however pleasant it may be in summer, gives it in late autumn a dank feel. In summer it affords good collecting, but in November I found but few insects and those mostly battered and forlorn looking. The fauna, though more Oriental than at Simla, a degree and a half to the north, was much more Palæarctic than at Lahore, which is yet half a degree north of Simla, but of course upon the plain.

A very clear picture remains with me of a bright sunny afternoon, with a raw chill in the air very suggestive of home. On the one hand were rhododendrons and Thujas growing as forest trees, and hard by cactus-like Euphorbias some fifteen feet in height; on the other, poplars were shedding their golden leaves in bright contrast to the crimson of the wild *Ampelopsis* (I cannot call it "Virginian" creeper), a "Brimstone"* butterfly dashes wildly past, then a belated "Tortoiseshell"† or "Red Admiral"‡ darts

* Probably *Gonepteryx rhamni*, var. *nipalensis*, but possibly a *Catopsilia*.

† *Vanessa kashmirensis*. ‡ *Pyrameis indica*.

up from the path only to return again to the same stone, while several "Small Coppers" (*Chrysophanus pavana*) disport themselves about the autumn flowers on the bank. Quite a Palæarctic picture surely!

In addition to these I found at Náini *Terias hecabe*, the Hairstreak *Ilerda sena*, Moore, and the Blue *Zizera maha*, Koll., also the Fossor, *Pompilus analis*, Fab., ♀, while *Agrotis flammatra*, Guen., came to light.

A climb to the top of China Peak (pronounced Cheena), 8568 ft., produced two more Palæarctic forms, *Argynnis lathonia*, var. *issæa*, and *Lycæna bætica*.

Five days were spent on horseback in an expedition into Kumáon as far as Ranikhet and Cháubattia, some twenty-four miles north of Náini as the crow flies. The road, at first slippery with ice so as to compel us to dismount, falls rapidly to Kháirna (Kháirana, or Khyrna, for the spelling seems uncertain). At about 6000 ft. *Ilerda sena* was again met with, at about 4000 ft. *Neptis astola*, Moore, and *Terias hecabe*. When near the bottom our eye was caught by the fluttering down of shells from a large pod-bearing tree. On looking up we saw about a dozen charming-looking greenish monkeys, their little black faces set off with most becoming white frills. It did not take them long to strip that tree of every pod.

At Kháirna, 3200 ft., a tiny village in a deep and narrow valley, I had a little time for collecting, but it was limited by the steady march of the great chill mountain shadow, which sent all butterflies quickly off to bed. *Precis orithyia* was common, but the specimens were very small; *P. œnone*, *P. lemonias* and *P. iphita* were also seen, the latter at flowers, not a usual habit of the species. Several *Athyma perius* were seen, also several *Catopsilia pyranthe*; of those taken one was the *gnoma*, the other of the *pyranthe* form. Of *Ganoris canidia* and *Tarucus telicanus*, Lang, I took one each, but *Zizera maha*, Koll., was in abundance. In addition to these were *Deiopeia pulchella*, flying for short distances about low herbage according to its wont, and a fly which hovered at flowers just like a Sphinx—a *Bombylius* not in the National Collection. The widely-distributed locust, *Thisoicetrus littoralis*, Ramb., which was very common, had the curious habit after its short flight of settling so brusquely upon a shrub as to make its branches shake, but then quickly making its way to the ground. I missed a *Macroglossa* twice at the same bush.

Late in the afternoon I took a *Papilio pammon*, a female of Wallace's Form II. *polytes*, which was flying about and into bushes, apparently seeking for a resting-place for the night, but possibly seeking where to lay its eggs.

Close to the village of Kháirna I saw upon the cliffs by the roadside several beautiful lizards, grey-spotted, with bright blue legs.

On the long and hot way up again from Kháirna to the ridge on which stand Ranikhet and Cháubattia, a dwarf *Precis orithyia* and a *Neptis astola*, Moore, were taken at about 3500 ft., and at about 4000 ft. *Belenois mesentina*, *Pyrameis indica*, and *Ilerda sena*.

At Ranikhet, 6000 ft. (where, by the way, the cooking at the Dák Bangla was the best that we came across in India), monkeys were not uncommon in the woods, but unlike our legumen-loving friends of Kháirna, of a revoltingly ugly type; butterflies, however, were scarce, and were represented by *Pyrameis cardui*, *Vanessa kashmirensis*, *Ilerda sena*, and *Lycæna maha*, Koll., var. *diluta*, Feld.

At Cháubattia, four miles to the east of Ranikhet, and at a height of about 6200 ft., the officers' quarters command a most glorious panorama of Nanda Devi, 25,749 ft., Nanda Kot, 22,491 ft., and Trisúl, 23,581 ft., mountains of unsurpassed grandeur of form and held most sacred by pious Hindus as sources of Holy Ganges. These stand between fifty and sixty miles away, yet shine forth as clear and bright as if close to. Here there were rather more butterflies, viz. our old friends *Terias hecabe*, *Precis œnone* and *P. lemonias*, *Pyrameis cardui*, and *Chrysophanus pavana*, and in addition something quite fresh, the Erycinid *Dodona durga*, Koll., of which I got three specimens; though a small insect it proved tenacious of life. A little beetle, *Oides sp.*, was taken flying over the road.

On descending again from Náini to the plains one found, as at Simla, that butterflies got more numerous and more Oriental in character. At the top of the road the Hair-streak, *Ilerda sena*, was common; at 5000 ft. *Yphthima philomela*, Joh., was met with; at the Brewery, *circa* 4500 ft., butterflies were very common at a flowery turn of the road, and I took *Pyrameis indica*, several *Precis iphita*, *P. lemonias*, and a male *Hypolimnas bolina*, while I missed a brown-and-white *Neptis*-like butterfly which may have been *Rahinda sinuata*, Moore.

Lucknow, lat. 27° N., alt. circa 500 ft.

November 24th and 25th, 1903.

Lucknow possesses a museum containing a fair collection of insects, which would have been more instructive to me if a majority of the species had been named.

My scanty collecting was almost confined to public gardens. Near the hotel was a small institution, either a children's orphanage or hospital, and in the garden attached thereto *Hypolimnas misippus*, ♂, was rather common, but shy and worn ; I took a battered one. Of *H. bolina* I took a female. Of *Delias eucharis* the males were common at *Zinnia* flowers. Odd specimens of *Papilio aristolochiæ* and *Parnara mathias*, Fab., also occurred.

In the beautiful garden of the Dilkusha Palace, where Havelock fell sick of the illness that was to prove fatal in the very hour of triumph, there was a great wealth of flowers and consequently a great assemblage of butterflies. Besides such things as *Papilio erithonius*; *Argynnis niphe* (a ♀); *Hypolimnas misippus*, several males; *Crastia core*, both typical and the variety *vermiculata*, Butl.; and a *Catopsilia* which evaded capture, I took there my first *Rapala melampus*, Cramer. This is a small copper-coloured butterfly belonging to a genus which, with its robust body, sharp-cut wings, and curious anal lobe to the hind-wing, looks very different from our Hairstreaks or Coppers. It is neither easy to see on the small flowers which it frequents, nor to catch.

Other butterflies taken in the same garden were the Blues *Catochrysops strabo*, Fab., and *Tarucus telicanus*, Lang, the latter abundant; *Mycalesis perseus*, and the brilliant tawny Skipper *Telicota augias*, L. A beautiful little Noctua with yellow under-wings, *Hyblæa puera*, Cram., was taken at flowers in full sunlight. The Blue *Zizera argia*, var. *similis*, Moore, was in abundance. I also took a locust, *Gastrimargus marmoratus*, Thun., a species of wide distribution.

By the roadside between Dilkusha and La Martinière a few *Chilades putli*, Koll., a very small brown Lycænid, were obtained.

At the Alumbagh, ever to be remembered in connection with Colin Campbell, the dry-season form of *Terias hecabe* was flitting quietly about, and I netted *Ixias marianne* (not so vulgar-looking as its name might lead one to

expect), also a variety of the female of *I. pyrene* without the orange-tip. A male of the wet-season form of *Huphina nerissa* was also taken, while *Delias eucharis* was common, a specimen feeding on *Zinnia* flowers close to Havelock's grave. *Deiopeia pulchella* was flying commonly in the sun amongst the grass, and with it a specimen of *Argina cribraria*, Clerck. The Coleoptera were represented by *Mylabris sidæ*, Fab., and the Micros by a Pyrale, *Pyrausta juncturalis*, Wlk.

In the Presidency garden I took only a worn *Acidaliid* and the common Cantharid beetle, *Mylabris sidæ*, Fab., which was seen in some numbers flying about the flowers of a species of *Hibiscus*.

Benares, lat. 25° N., alt. 270 ft.

November 28th—December 2nd, 1903.

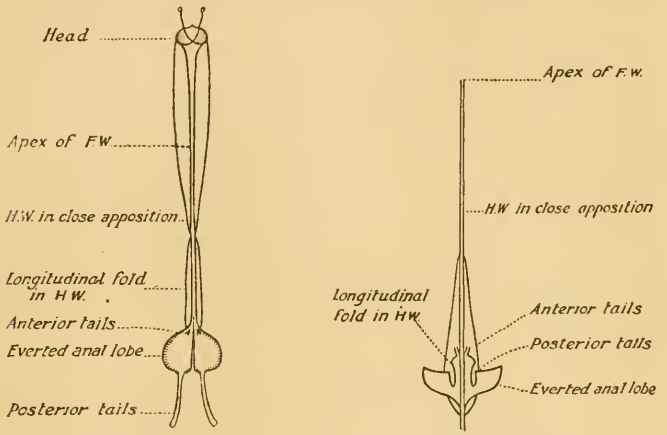
The sacred city of the Hindus proved more remarkable for the number and variety of its pilgrims than for its butterflies. In the hotel garden, where jackals howled loudly by night, a few battered specimens of *Papilio erithonius* were seen by day, and the males of both species of *Hypolimnas* were fairly common. Of *H. bolina* I took a fine female, while of *misippus* I also sent home a female which is marked "common." It is, however, certain that I did not know this insect to be a *Hypolimnas* at the time, since I only learned from the Calcutta Collection that the female of *misippus* was brown! There is therefore little doubt that I took it for a variety of *Limnas chrysippus* which it mimics in such a surprising manner, and which certainly was common enough in the same garden. It is one of the inconveniences of the method of enveloping that so much is left to memory, and the chances of comparing insects are so very few. Dwarfed specimens of *Precis orithyia* were now very common; *P. œnone* and *P. lemonias* were less common but almost as small. Several *P. almana* occurred. But in spite of the excessive drought and the consequent occurrence of dwarfs, one of my specimens of *Terias hecabe* taken at Benares was quite of "wet-season" type. *Catopsilia pomona* was represented by a very large male of the typical form and a smaller female in fine condition, exhibiting the transition to the *catilla*, Cr., or extreme dry-season form. Similarly *C.*

pyranthe was represented by a male of the typical and a female of the *gnoma* form.

Together with the above were several smaller things: among the Blues *Polyommatus bæticus* occurred, while *Catochrysops strabo*, Fab., and the tiny *Chilades putli*, Koll., were both common. The Skipper *Parnara mathias*, Fab., was also common, and I took one *Telicota augias*, L. The little Pyrale, *Hymenia recurvalis*, was in some numbers in one small flower-bed. Of the long-waisted wasp, *Eumenes esuriens*, F., I saw but one ♀.

APHNÆUS ELIMA, Moore.

Enlarged from sketches from the living butterfly.



Diagrammatic view from *above*.

Diagrammatic view from *behind*.

Drawn at Benares, November 30th, 1903, by G. B. Longstaff.

But among the frequenters of the small garden adjoining the hotel those that interested me most were the "lobed" and "tailed" Lycænids, of which there were no less than four species. Of *Aphnæus ictis*, Hew., I took but one, a male, of *A. elima*, Moore (which, however, De Nicéville considered to be only a dry-season form of *ictis*), I secured two, also males. Of the third species, *Pratapa deva*, Moore, I took but one, and that had lost the anal angles, with their appendages, and a large part of both hind-wings, which had apparently been bitten off, absolutely symmetrically, by a lizard. The fourth species, *Rapala melampus*, Cramer, was common, and I secured seven specimens, all, however, males.

Concerning *R. melampus* I wrote to Dr. Dixey at the time: "The Tailed Copper (or Hairstreak) first seen at Dilkusha, Lucknow, and found commonly here to-day, greatly interests me. Not only is it very beautiful, but it is surprisingly hard to see, especially when at rest. Then the structure of the hind-wing is most strange; posterior to the tail (the next interspace but one) a portion of the wing nearly circular, with a very obvious fringe of large scales, is set at right angles to the plane of the wing and to the direction of the veins."

According to Schatz and Röber * this "anal lobe" occupies the space between the sub-median and inner marginal veins; the second anal and third anal of Comstock; 1*b* and 1*c* of Meyrick; but I have not found in these authors any allusion to the striking fact that this lobe is quite out of the plane of the wing. This omission may be due to the fact that the process of setting usually flattens the lobe out so that it is hardly seen in cabinet specimens. It did not occur to me at the time (and the suggestion arrived by letter too late) that the object of this structure is possibly to produce the appearance of a head in a non-vital part, the tails representing the antennæ. However, drawings made at the time strongly bear out the suggestion. The resemblance would be still more striking if these Lycænids, like so many of the family, habitually rest with the head downwards.

In another letter from Benares I said: "Thorns are not specially bad here, only that one does not know the look of many thorny plants until too late. But, on the other hand, burrs of every sort and kind abound to an incredible degree and tangle up the net; much of one's time is spent in freeing net and breeches therefrom."

It might have been added that at Benares I first made acquaintance (somewhat intimate) with "spear-grass," which is yet more provocative of bad language than either thorn or burr.

Some three miles from Benares, on the way back from Sarnáth, where Buddha first taught, I found *Delias eucharis* in extreme abundance in a small field of the tall marigold which is so much cultivated for the service of the temples. A truly gaudy sight it was to see crowds of these white, yellow, and scarlet butterflies upon the orange-coloured blossoms.

* *Die Familien und Gattungen der Tagfalter.*

Calcutta, lat. 22° 30′ N. Near sea-level.

December 4th—12th, 1903.

Naturally one could not expect to turn up anything new at Calcutta, the capital of India, and long the home of De Nicéville, that martyr to science who met his death in the deadly Terai when in pursuit of his favourite butterflies. However, I determined in the few days at my disposal to get at any rate a sample of the fauna of Lower Bengal.

The Eden Gardens, abutting on the Máidán and close to Government House, bear much the same relation to Calcutta as Kensington Gardens to London, and from their proximity to the hotel afforded a convenient collecting ground for odd hours.

The *Duranta* was nearly over and the most attractive feature proved to be a hedge of *Lantana* in full bloom. These dissimilar plants both belong to the *Verbenaceæ* and are both natives of the West Indies, although the latter appears to have run wild in many parts of India. On that hedge *Limnas chrysippus* was in abundance, accompanied by *L. genutia*, which I had not seen since I was at Malakand, while numerous *Tirumala limniace* and *Crastia core* completed the company of the Danaids. I was able to confirm my Benares observation that the male of *L. chrysippus* has a slight but decided odour suggestive of cockroaches, which is perhaps stronger when the scent sacs on the hind-wings are opened, though of this I am not sure. On the other hand, the male of *C. core* has a faint scent that suggested to me rancid oil, or old lamps. So far as I could judge the scent is connected with the hind-wings but *not* with the very conspicuous genital tufts.

At the *Lantana* flowers along with the Danaids were abundance of *Suastus gremius*, Fab., a somewhat dingy Skipper, also a few of the brilliant and conspicuous *Delias eucharis*. The upper-side of the female of this species faintly mimics *Tirumala*; the male yielded on rubbing the wings a sweet flowery scent, which I was not at first able to describe, but later it struck me as resembling that of our domesticated *Ganoris rapæ* and suggestive of sweet-briar. Dr. Dixey informs me that scent-scales are very numerous in *Delias*.

In the shadier parts of the garden together with numerous *Terias hecabe*, one at least of markedly wet-season type, and many *Yphthima hübneri*, Kirby, several *Nychitona xiphia* were found, which, as ever, reminded me of

Leucophasia sinapis, a slender form and fragile appearance being in each case associated with a weak flight close to the ground. One of the *Y. hübneri* had the whole hind margin of both secondaries bitten off nearly symmetrically.

Catopsilia pyranthe and *C. pomona* were both met with, the former the more frequently. No *Papilio* turned up although I was told that *P. pammon* occurs in the garden. Amongst young palms the males of *Elymnias undularis*, Dru., were occasionally disturbed, and a very striking thing it is. Then *Nepheronia hippia*, F., came along, flying strongly, the male looking on the wing, or more especially when settled on a flower with wings expanded, much bluer than its cabinet appearance might lead one to suppose. Three *Limenitis procris*, Cr., required some catching, preferring the leaves of tall shrubs to flowers; but it is scarcely as graceful on the wing as our White Admiral.

I took two specimens of *Catochrysops pandava*, Horsf., var. *bengalia*, De Nicév. (being the dry-season form); the female is a dingy creature, but the male is of an iridescent blue, bordered with black. *Hypolimnas misippus*, ♂, *Precis almana* and *P. lemonias* completed the list of twenty species taken in four visits to the gardens. With them was a bee *Elis thoracica*, Fab., a ♀.

Báliganj.

At the truly splendid museum (where, by the way, I saw a native artist at work producing some of the very best coloured figures of beetles and butterflies that I have ever seen), Mr. S. E. Peal, besides helping me in other ways, put me on the track of one of the late Mr. De Nicéville's favourite collecting-grounds, a *rus in urbe*, at Báliganj, a suburb only three miles from the hotel. I visited this place twice, on December 5th and 9th. It consists of a large deserted garden long run wild; weedy meadows and jungly woods are all that is left of trim lawns and ordered shrubberies, while a palm avenue and several tanks covered with a floating flower of the convolvulus order, harbouring countless dragon-flies, complete the tale of departed greatness. Altogether it is full of sad beauty. Palms and crotons with an undergrowth of ferns were the characteristic plants, flowers were few, yet in certain favoured spots butterflies were in quite bewildering swarms. The quiet charm of this old garden was greatly enhanced by the absence of curious natives and the (comparative) absence

of burrs, that curse of "up-country" collecting, though the unsuspected prickles of innocent-looking palms to some extent took the place of the latter.

Some of the species seen near the centre of the city, in the Eden Gardens, were conspicuous by their absence, e. g. *Limenitis procris*, *Precis lemonias* and *Hypolimnas misippus*.

The four common Danaids, *Tirumala limniace*, *Crastia core*, *Limnas genutia* and *L. chrysippus*, were not so common as might have been expected, probably owing to the scarcity of the flowers they love. In the last-named species I was able once more to confirm the presence of a distinct, but not strong, odour suggestive of cockroaches. A few *Papilio polytes*, both sexes, gave to the assemblage that air of distinction which the genus always has. Among the more sombre things, most frequent under the shade of groves, were a number of *Mycalesis indistans*, Moore, together with one *M. perseus*, Fab., which so far as observed have no "list" when at rest. In the shade also were two or three *Melanitis ismene*, Cr. Close down among the herbage together with *Yphthima hübneri* there were flying large numbers of *Y. philomela*, certainly a gregarious species.

Precis almana was noted and *P. atlites*, Joh., here came under my observation for the first time, but in poor condition; it is then a rather ghostly-looking butterfly though a somewhat strong flier; this last is also true of *Atella phalanta*. A single specimen of my old Amritzar friend *Euthalia garuda* was observed, as before, to settle with its wings fully expanded and closely appressed to the ground. *Elymnias undularis* was in abundance; it is especially addicted to the characteristically Indian butterfly habit of flying into or through bushes, and even of flying about inside bushes. It is clearly gregarious, several specimens flying about and in one palm-bush, its food-plant. The male is very striking on the wing, and when settled, even though the under-side is somewhat leaf-like, it is yet quite conspicuous. The female, on the other hand, is on the wing a very fair mimic of *Limnas genutia*, but its flight is weaker.

Catopsilia pyranthe and *C. pomona* were both rather common; *Terias hecabe* was abundant, and, as usual, gregarious.

In half-shaded spots an occasional *Nychitona xiphia* flitted slowly along close to the ground. *Ergolis ariadne*,

L., was abundant, of *E. merione*, Cr., two specimens were secured. The butterflies of this genus settle with the wings three-fourths expanded.

Nepheronia hippia was rather common; though its female somewhat mimics *Tirumala limniace*, the male, when on the wing, looks much bluer than that insect.

A brilliant fulvous Skipper, *Telicota bambusæ*, Moore, was the only representative of the group, but there were several Blues, to wit *Catochrysops strabo*, Fab., which was common; *Lampides celeno*, Cr., larger than usual, one being of the form *alexis*, Stoll.; and *Neopithecops zalmora*, Butl., was common. A single example of *Curetis thetys*, Dru., fell to my net, apparently bitten by some enemy; its silvery white under-side is very striking. But perhaps the strangest-looking butterfly of the lot was *Loxura atymnus*, Cr., of which I got two. Its wings are much plaited longitudinally, and when at rest its extremely long tails, crumpled look, and brown colour give it quite the look of a dead leaf. A closer examination shows that the portion of the hind-wing near the anal angle is bent down, or back, nearly to a right angle; this bent portion is, however, relatively smaller, more oval and less sharply bent than the rounder anal lobes of *Rapala* and *Aphnæus;* moreover it is not furnished with the very large marginal scales which are so conspicuous in those genera.

Toliganj. December 7th, 1903.

About two miles from Báliganj, and due south of Calcutta (about half-a-mile beyond the Sports Club), is the locality referred to as Toliganj. Here too is an old abandoned garden, but lacking the elements of departed grandeur that give a poetic colouring to De Nicéville's old hunting-ground. The prominent features are a great profusion of *Lantana* in full bloom, a bamboo grove and a good deal of thorny jungle. The day that I was there the *Lantana* was the chosen haunt of great numbers of the bigger butterflies such as *Delias eucharis, Tirumala limniace, Limnas genutia, Papilio pammon*, mostly worn, *P. aristolochiæ*, and a few *P. erithonius*, together with an occasional *Nepheronia hippia*, with his broad wings proudly expanded to view. The sight of these big fellows, expanding from three to four inches, quietly settled on the flowers, or fluttering after the manner of *Papilio*, or grandly sailing around gorgeous in their white, yellow and scarlet,

black and grey blue, mahogany-brown and black, black and cream colour, black and coral-red, black and yellow, or sky-blue and black, afforded indeed a glorious sight not soon to be forgotten. Alas! such a tropical glory takes much colour out of the most vivid mental pictures of butterfly life at home.

In a shady grove not far from these flowers *Limnas genutia* was simply swarming, as many as ten or even twenty being in sight at once, for it is one of the most gregarious butterflies that I have met with. A few observations on this species and *Tirumala limniace* failed to detect any odour, but it was far otherwise with *Delias eucharis*, of which several specimens had a distinct sweet scent, very like that of *G. rapæ*. My strong impression is that this scent is confined to the male, but I cannot, unfortunately, speak with certainty on the point. The male of *Huphina nerissa* has a distinct scent, also like that of *G. rapæ*, although the butterfly more resembles *G. napi*. The scent of these two butterflies is neither so strong nor so unmistakably characteristic as that of *G. napi*, but its existence is quite beyond question.

These scents are not easy to deal with. The human nasal organ is but a poor affair at best, moreover scents are very hard to describe, and these butterfly odours are only suggestive of, certainly not identical with, those to which I have, for want of any better standard, compared them. Then the scents are transient and may easily be scattered by the wind or overpowered by neighbouring flowers. Again the scales, independently of any scent, are irritating to the mucous membrane. Lastly, any one who has tried to use the sense of smell for diagnostic purposes must know how even the most volatile perfume is apt to linger on, lurking as it would appear in the cavernous recesses of the nose. Of course it is much easier to determine in the field whether or no a scent is sexual in those species in which the sexes are distinguishable by very obvious characters. Lastly, it should never be forgotten that in all probability the scents described are far more obvious to the insects themselves than to human observers.

Only a solitary representative of the *Euplœa* group appears among the Toliganj specimens, but its envelope bears the note: "Common, has a slight peculiar scent, rather disagreeable." Most probably I believed this at the time to be the common Calcutta species *Crastia core*, but it turns out to be *Pademma kollari*, Feld., and it is now

impossible to say what those that I passed over or missed were.

In variety the Toliganj flies were disappointing, but, besides the above named, they included a very fine female *Ixias pyrene*, the sole Orange-tip seen at Calcutta; a few *Catopsilia pyranthe*; several *Ergolis ariadne*; *Elymnias undularis*, not common; plenty of that very distinct Blue, *Neopithecops zalmora*; a single specimen of *Loxura atymnus*, and plenty of *Yphthima hübneri*, *Y. marshalli*, *Y. philomela* and *Nychitona xiphia*.

The list is closed by "*Melanitis ismene*, lover of darkness, as its name seems to say. It flitted about everywhere dressed in all the tints of fallen leaves, or, alighting among them, fell partly on one side and was one of them."* I quote the words of E. H. A., that keen observer and telling writer. The few specimens that I saw that day were very dark and of the "dry season" form. A note made at the time says: "This shade-loving species, which only flies for a *very* short distance and settles on the ground, has a 'list' to the right of 20–30°, making it very like a dead leaf."

A parasitic bee, *Crocisa histrio*, Fab., was caught feeding on the wing like a Sphinx.

On December 8th, I visited the grand Botanic Gardens at Howrah, but it was too late in the day for many butterflies to be about. I noted, however, *Lampides celeno*, Cr.; *Mycalesis indistans*, Moore, a *Delias* and two or three *Terias*. Late in the afternoon, just before leaving the gardens, I noticed a few *Limnas genutia* fluttering about a palm-tree prior to settling down for the night. On looking carefully I noted on one of the huge leaf-stalks, some twelve or fourteen feet from the ground, a *cluster* of the butterflies *hanging together like swarming bees*. By pelting with sticks and stones the cluster was broken up and proved to consist of at least seven or eight individuals. Altogether there were perhaps twenty in and about that tree. This certainly establishes for *L. genutia* the character of gregariousness. Both Mr. S. E. Peal and Mr. F. Möller told me that they had never seen such a thing.

Darjiling, 27° N., alt. 7000 ft.

December 13th—22nd, 1903.

I set off to this celebrated hunting-ground with great

* "A Naturalist on the Prowl," p. 203.

misgivings as to season, but still full of wild hopes. The ascent by the cog-wheel railway took us through a most interesting forest, where amongst other things we saw our first tree-ferns. Near Tindaria, at about 3000 feet, I saw several *Ixias pyrene* and succeeded in catching one from the train while it was going at full speed—about seven miles an hour! This was a male of the large form *evippe*, Drury.

Before reaching Kurseong, nearly 5000 feet, where I had arranged to sleep with a view to getting a little collecting, we got into the clouds, and at our destination it was very cold, with an atmosphere only too like that of the West of Scotland. During a gleam of sunshine I took a *Vanessa kashmirensis*, a poor dull thing compared to our *urticæ*. At night two moths, an Acidaliid, *Synegiodes hyriaria*, Walk., and *Caradrina albosignata*, Oberth. (thought by Sir G. Hampson to be probably identical with *lineosa*, Moore), came to light.

The following morning was brighter and we started early to walk up to the next station, Toong, but though the weather was more benignant, the railway ran through a district devoted to tea-growing which did not promise well. A few *Vanessa kashmirensis*, a *Pyrameis indica* and a *P. cardui* flew along the road, the latter with both apices of the fore-wings and one hind-wing near the anal angle apparently bitten. Near Toong station, 5500 feet, in a sheltered and flowery spot I took single specimens of the Hairstreaks *Ilerda epicles*, Godart, a female, and *Camena cleobis*, Godart; the latter on the upper surface like *T. quercus*, but bluer, on the under-side almost white with a practically black spot on the anal lobe. Here also I took a male *Hiposcritia lalage*, Dbl., and a native caught in his fingers a *Dodona eugenes*, Bates (an Erycinid), and the same man brought me a fine Saturnid moth, *Rhodia newarra*, Moore, 6½ inches in expanse, apparently recently dead.

As the train rounded the last corner we came in full view of the Kangchinjunga range, rising majestically full four miles above us. No words can describe the grandeur of the scene and we were fortunate indeed in having it clear throughout our stay. Yet, entomologically speaking, it was the saddest of disappointments, for it was as cold as England in November and the local entomologists—Messrs. Möller and Lindgren—assured me that *Kallima* was hopelessly over, as indeed were most things. They, and every one we met, spoke of the astonishing multitudes of

butterflies in the rainy season; the harder it rained, they said, the more insects there were in the short interludes between the showers.

On the high ground I got little; *Vanessa kashmirensis*, *Pyrameis indica* and *cardui*, none of them common, also a brilliantly-coloured beetle, a species of *Cassida*. I saw a school-boy catch *Colias fieldii* and a tailed "blue." At Jalapahar, 7500 feet, I got a female *Huphina nadina*, Luc. [=*remba*, Moore].

The only chance was to go down into the valleys, but it takes long to descend, and as the butterflies are for the most part only "at home" from 10.0 a.m. to 2.0 p.m., one does not get many hours' collecting; moreover, from those precious hours there are deductions to be made for cloudy times, and for the shadows of woods, and the still deeper shadows of lofty mountains.

My first expedition, lasting three days on horseback, was to the Tista valley, lying to the east of Darjiling. December 17th, we went to Pashók, about 17 miles, sleeping at the Public Works Department rest-house, about 2300 feet above the river, and about 3000 feet above the sea.

When we got down to about 4000 feet above sea-level insects began to get fairly numerous, although it was late in the day for butterflies. *Vanessa kashmirensis* was common, and with them were several *Pyrameis indica*. I secured two of the handsome White *Hiposcritia lalage* [=*argyridana*, Butl.], both females. Several *Neptis astola*, Moore, were seen, mostly worn. At a shady turn of the road I got *Lethe rohria*, F., an *ægeria*-like Satyrid butterfly; close by *Arhopala areste*, Hew., flashed azure in the sunlight, but a specimen of another beautiful Lycænid, *Spindasis vulcanus*, F., was badly battered. Of *Abisara flegyas*, Cr., and *A. fylla*, Doub., I netted one each, and a large bee, *Bombus funerarius* ?, Smith, a ♂, tempted me to catch him.

In the wood in which the rest-house stands *Mycalesis indistans*, Moore, was in abundance; this is a typical shade-lover; when kicked up from the herbage it flaps about three yards, like *Epinephale janira*, L., and then settles on dead leaves or on the earth. Some of them had a slight "list," but this did not seem to be a marked habit, possibly because this position is not so advantageous in shade as in sunlight, though the habit was first noticed in *Melanitis*,

a typical shade-loving genus. The existence of shade-loving butterflies would seem to be correlated to a tropical sun, but even in England *P. ægeria* and *E. hyperanthus*, L., still more *L. sinapis*, are what I should term "partial shade-lovers."

In the same wood, also in the shade, *Terias læta* and *T. hecabe* were both common, and in sunnier glades the common Indian Blue, *Lampides celeno*, Cr., was both abundant and gregarious. In a young cinchona plantation close by I found *Ganoris canidia*; a Blue, *Cyaniris puspa*, Horsf.; and a handsome very large Skipper, *Celænorrhinus leucocera*, Koll. In the rest-house there was a dead Pyrale, *Lepyrodes geometralis*, Guen.

The next day, December 18th, I sent my pony on ahead, and walked down to the river collecting on the way. In the cinchona plantation close to the rest-house I found *Zemeros flegyas*; lower down were *Euthalia appiades*, Mén., of which I saw several worn specimens; a Hairstreak, *Arhopala bazalus*, Hew., like a glorified *T. quercus*; *Lethe verma*, Koll.; and *Melanitis ismene*, the last as usual a shade-lover.

A path leading off through the wood brought me to a tea-garden, perhaps 1500 feet above sea-level, where I lingered all too long. Tea-gardens are not as a rule good places for butterflies, and the flower of the tea-plant, then just coming out, does not appear to have attractions for them, but this particular garden, just at the edge of the forest, and especially that corner of it where the little stream runs in, was certainly very prolific.

Athyma ranga was in abundance, though worn; likewise its relatives of the genus *Neptis*, but the three specimens that I sent home belonged to as many species: *N. aceris*, Cramer; *N. astola*, Moore; and *N. varmona*, Moore; the closely allied, but brown and black, *Symbrenthia hyppoclus*, Cr., was almost as common among the tea-bushes. Of the satin-winged *Hiposcritia indra*, Moore, I took two females. Of the following I got single examples only:—*Caduga melaneus*, Cr., and the very similar *Parantica melanoides*, Moore, two black and white Danaids; *Athyma selenophora*, Koll.; *Yphthima philomela*, Joh.; *Arhopala centaurus*, Fab.; and *Castalius anaura*, De Nicév., ♀, while another Blue, *Lampides elpis*, Godt., pale and beautifully sheeny, was common. I also missed what was, I believe, *Libythea rama*, Moore. There were in

addition two moths, an Arctiid, *Leucoma submarginata*, Walk., and a Nyctemerid, the fuscous-and-white *Zonosoma cenis*, Cram. (= *interlectum*, Walk.), the former possibly, the latter certainly a day-flyer.

At last I dragged myself away and an hour later reached a most attractive flowery bank immediately above the river. This was evidently a great place, for in a very short time I secured two sadly battered *Papilio memnon*, L., of the form *agenor*, L.; a large male *Ixias pyrene* with the fore-wings almost symmetrically bitten near the tip of the costa; also an insect that I had greatly desired to take, the lovely and delicate-looking "map-butterfly," *Cyrestis thyodamas*, Bdv., in splendid condition. This, a Nymphalid, by the possession of a well-marked anal lobe to the hind-wing suggested the *Rapala* group of Lycænids, but a close examination of the veins shows that neither lobe nor tail is homologous in the two widely separated genera. In addition to the above I took a second *Caduga tytia*, Gray, the first having been netted 1000 feet higher. This blue-and-black Danaid is distinguished by having brown hind-wings. Time was however getting on and my "sais" was waiting with the pony by the little bridge, so I reluctantly mounted. I had not ridden far when I caught a glimpse of *Kallima inachis*, Bdv., flying by the roadside; flinging myself out of the saddle I was fortunate in netting the butterfly of all others that I had wished to see alive. It proved to be a fine female; I could not afford to risk waiting to see her settle, and alas! never saw another. A few minutes later my sais brought me a damaged *Euplœa* with a lovely purple gloss; seeing many about I foolishly did not keep it. These things happened close to the Tista bridge, by which the road to Lhasa crosses the river, here only some 650 feet above the sea, so deeply are these Himalayan valleys cut down. Sad to say in a few minutes the winding of the road took me under the deep chill shadow of the mountain and the purple-glossed *Euplœas* and nearly all the other butterflies vanished for that day. A solitary *Neptis accris*, Cr., together with a few *Ixias pyrene*, *Huphina nerissa* and *Lampides elpis*, were all that I saw; with them was a Nyctemerid day-flying moth, *Trypheromera plagifera*, Wk.

The rest-house at Riang was reached too late for any more collecting, and I had to content myself with watching the long trains of Colonel Younghusband's bullock wagons painfully dragging loads of compressed hay for the Tibetan

expedition. Alas for the once fair road, now a foot deep in white dust!

December 19th. *From Riang by way of Mongpu and Sareil back to Darjiling.* This was such a long march that little time could be given to collecting, moreover many hours were spent passing along a beautiful forest track in the deep afternoon shadow of the mountain. At the start, close to the river, the silvery-white *Acropteris vagata*, Moore, was conspicuously spread out upon a leaf, this was the only Uraniid that I met with. Near Mongpu, at about 3000 feet, *Ergolis merione* was very common about *Ricinus*, the castor-oil plant, upon which its larva feeds. A little higher up I came across *Ticherra acte*, Moore, a Lycænid with very long tails that wave with the wind; it has a swift jerky flight. The hind-wing of this species is much plaited but the anal lobe is rudimentary.

Other captures were *Huphina nerissa*, a male; *Ganoris canidia*, a female with all the hind margin of the hind-wing gone; *Tachyris hippo*, Cr., a male; *Arhopala rama*, Koll.; *Neptis astola*, Moore; *Ilerda epicles*, Godart, with all the hinder part of the secondary apparently bitten off by a lizard; *Cirrochroa aoris*, Dbl., which I had seen at Pashók on the previous day; *Lethe rohria*, very like *P. ægeria* in its habits and liking for partial shade; and *Argynnis niphe*, this last in the cinchona plantation at about 3600 feet. A large white butterfly, bright yellow underneath, fluttering at the sweet white flower of the cinchona led me to dismount, and it was well that I did so, for it turned out to be *Prioneris thestylis*, Dbl., and fortunately a female, which must be very much the less common sex, at any rate the Hope Collection contained no female of the genus.

The next day, December 20th, I rode down to the Ranjit River, the boundary of Sikkim, *the* great Papilio country. Distance however reduced my actual collecting to less than four hours.

At about 3000 feet I took two of the Erycinid *Zemeros flegyas*, also *Symbrenthia hyppoclus*. The chief collecting-ground was near the suspension bridge leading into Independent Sikkim, closed this year to all Europeans, including entomologists, on account of the Tibetan difficulty. It was trying to one's European temper to be stopped by a coloured policeman, while natives passed freely over!

Here, some 8000 feet above the sea, the first thing that I happened upon was *Limnas chrysippus* in extreme

abundance in a very limited locality, it was in fact decidedly gregarious. By the way, pinching and cyanide are both but very imperfect ways of slaying these tough-skinned Danaids.

Elymnias undularis, both sexes, was common, but I did not see any *L. genutia* for its female to mimic; although the under-side of this butterfly is "leaf-like," it is, as a fact, usually conspicuous when settled.

I caught distant glimpses of two Papilios and I missed my first *Hebomoia*, in fact the things that I missed that day would have made quite a good collection!

The following were all common: *Huphina nadina* and *H. nerissa*, both males; *Ixias pyrene*, large; *Neptis aceris*, Cr.; *Precis iphita*, spreading out like a *Eupithecia* when settled; *Symbrenthia hyppoclus*, and *Lampides celeno*, Cr., while *Terias hecabe* was very abundant and large.

Other things taken were *Yphthima marshalli* and *Mycalesis mineka*, Moore, this last a very dingy species. In marked contrast was *Jamides bochus*, Cr., the male iridescent dark-blue above, quite gem-like, beneath dull grey with a metallic ocellus at the anal angle of the hind-wing; the female comparatively dull in colour.

For some reason I that day missed a larger proportion than usual but managed to catch the following:—*Prioneris thestylis*, a male; *Cirrochroa aoris*, looking on the wing like a big *Argynnis*, but settling with wings half-expanded, several seen, but only one netted; a *Charaxes athamas* taken on a flower was the only individual of the genus that I got in all my travels. Another specimen of this very distinct and beautiful species was soon after seen feeding upon human ordure! Fear of fouling my net prevented me from striking down upon it, and it suddenly darted up, went twice round with a swift jerky flight and then disappeared. Mr. Möller had indeed told me that *Charaxes* was a very foul feeder.

The elegant day-flying moth *Trypheromera plagifera*, Walk., must be added to my list, as well as the little Geometer *Psilocambogia memorata*, Walk., which I found dead, caught and set out upon a burr (of some composite flower). Lastly a beetle, *Mimela horsfieldi*, Hope, of brilliant green with coppery tinge.

The extraordinary abundance of dragon-flies of many kinds at the Ranjit River was remarkable, yet I did not once see a butterfly attacked by any of them.

I left Darjiling on December 22nd, with much regret, and a strong desire to return at a better time of the year. On the way down, at about 4000 feet, *Ixias pyrene* was common, while close to Tindaria station, at about 2900 feet, I netted from the train a pale Blue with a whitish patch on each wing, *Cyaniris dilectus*, Moore, as well as another Blue, *Cyaniris ladon*, Cr., form *pseudargiolus*, Boisd., and an Acidaliid, *Idæa remotata*, Guen.

At Tindaria I left the train and walked down to Sukna. The following things were met with: (1) At altitudes of from 2800 feet to 2000 feet:—

The Erycinid, *Zemeros flegyas*, Cram., almost abundant, but rather worn; *Mycalesis indistans*, Moore; *Precis lemonias*, a small specimen in fine condition, also large ones worn [this and *P. iphita* were the only species of the genus met with in the Darjiling district]; single examples of *Neptis aceris*, *N. astola* and *N. varmona*; *Symbrenthia hyppoclus*, common; *Lampides celeno*, Cr., form *alexis*, Stoll., also common; *Ganoris canidia*, a female; *Huphina nadina*, a male, about 3000 feet; *H. nerissa*, a male, about 2500 feet; *Tachyris hippo*, a very fine female; *Terias hecabe*, abundant, two males, one of them dwarfed, were of the variety without the "dog's head."

(2) At altitudes of 2000 feet to 1500 feet:—Here I took *Catopsilia pyranthe*, a male; *Yphthima marshalli*, two; *Huphina nerissa*, worn males were common; *Precis lemonias*, several; *Terias libythea*, common; and the Blue, *Zizera otis*, Fab.

At about 3.30 p.m., I watched a fine specimen of *Papilio aristolochiæ* flying very slowly about herbage, apparently seeking for a resting-place for the night, just as I had seen *P. pammon* doing at Kháirna on November 18th; near the same place I missed two specimens of a black-and-white Danaid.

(3) A little way above Sukna, perhaps at about 700 feet above sea-level *Orsotriana* [*Mycalesis*] *runeka*, Moore, was in the greatest abundance in a deeply-shaded wood; this, a typical shade-lover, is sluggish but is on the move later than most things (for it was just before sundown), but when kicked up from ferns or other low herbage it did not fly more than two or three yards. It varies greatly in the pale streak on the under-side which may be white and very conspicuous or almost obsolete. One specimen exhibits a well-marked bite on the hind margin of both hind-wings

above the anal angle, the injuries on both sides corresponding closely.

It was dark when I reached Sukna station, 500 feet above sea-level, and fireflies, *Luciola* sp., were flitting about on all sides. A "flare" lighted just before the arrival of the train attracted many moths, of which I secured a large sharp-winged transparent Pyrale, *Cydalima conchylalis*, Guen.; and the Noctua, *Prodenia littoralis*, Bdv. In the train, immediately after starting I bottled a strange-looking ♂ winged ant, *Dorylus juvenculus*, Shuck.

Thus closed my short Darjiling campaign, and leaving behind with much regret the awe-inspiring Himálaya, we steamed away into the darkness over the monotonous plain of Bengal.

Bankápúr, lat. 25° 30′ N., alt. c. 250 ft.

December 22nd, 1903—January 3rd, 1904.

In absolute contrast to Darjiling, Bankápúr, the civil station of the great city of Patna, is situated on the level, monotonous, and highly-cultivated plain of the Ganges, affording little harbour for butterflies, so that a fortnight's stay with old friends at the hospitable parsonage yielded small entomological results.

In spite of these unpromising surroundings, *Limnas chrysippus* was common, and in company with it *Hypolimnas misippus*, of which I saw several males and secured one female, which latter so closely mimics the former species that even the small white spots on the thorax and head are reproduced!

Of *Tirumala limniace* I saw a solitary example, of *Crastia core*, two; but the other very common Danaid, *Limnas genutia*, was abundant in a mango orchard, and distinctly gregarious in its habits. It has rather an unpleasant scent, but whether or no it is confined to one sex I regret that I failed to notice.

The Satyrids were represented by a solitary *Mycalesis perseus*; the Swallow-tails by *Papilio pammon*, worn, *P. aristolochiæ*, and *P. erithonius*, the last a flower-loving species. *Precis* was represented by four species: *almana*, one of them with large pieces, in part corresponding, bitten out of each hind-wing; *œnone*, one; *lemonias*, several; and *orithyia*, several, the latter all small. Single specimens of the common and generally distributed *Atella phalanta* and

Ergolis merione were seen in gardens. A fine *Limenitis procris* was taken sipping "toddy" from a palm; I missed him at the first shot, but he foolishly returned to his fatal liquor.

Of *Catopsilia pyranthe* I took two males and a female. I held one of the former fluttering beneath my nostrils, when it gave out a strong scent that instantly brought *greenhouses* to my mind, then my own greenhouse, then *Polianthes tuberosa* (barbarously termed by nurserymen "tuberose"), and lastly jasmine. I do not think that I ever smelt so distinct a scent in a butterfly, always excepting the male of *Ganoris napi*. The other male *pyranthe* I held under my nose while I stroked the "feather-tufts" of the hind-wing; this at once elicited the odour of jasmine, further confirming the observation of Wood-Mason.

Two males of *Huphina nerissa* bear the following notes: "Scented, not like *napi*, more like *rapæ*," and "this specimen had a scent like *P. rapæ*, i. e., of the sweet-briar type." Again a *female* of *Delias eucharis* (which was common) bears the note, "has a scent much like *rapæ*," and the specimen appears to have been wilfully rubbed. My observations on butterflies in England show that in some cases *females* have a scent, but not like, or as strong as the males. My strong impression is that the *male* of *D. eucharis* has the *rapæ*, or sweet-briar scent.

The three species of *Terias*, viz. *hecabe*, *libythea*, and *læta*, were all common; one of the *læta* appears to have been bitten by a bird.

Nychitona xiphia was not uncommon, and several *Ixias marianne* were seen. *Chilades varunana*, Moore (according to De Nicéville the wet-season form of *C. laius*, Cr.), was common about irrigated flower-beds, indeed Blues are wonderfully fond of water. The only butterfly seen at Bankápúr that was at all out of the common, besides *Limenitis procris*, was the large grey Lycænid *Virachola isocrates*, Fab., of which I took one at flowers in the Commissioner's garden. I noted that its hind-wings were much folded posterior to the tails, the convexities of the folds being towards the upper-surface. These foldings of the wings are not well seen in set specimens.

Although Bankápúr is far from being a good locality, it will give some idea of the abundance of butterflies in India when I say that in mid-winter, December 24th, I took in a suburban garden within three-quarters of an hour no less

than ten species, some of them represented by numerous individuals.

Buddha Gáya, lat. 24° 42′ N., alt. c. 500 ft.

December 30th and 31st, 1903.

The vicinity of the shrine and its sacred Bo tree was not productive. All the butterflies that I saw there were one *Terias libythea*, a number of *Huphina nerissa* (the male yielding a distinct, but not strong, flowery scent), together with a lot of the Lycænid *Zizera karsandra*, Moore.

The next day, on a steep hill of red trap rock overlooking the town, I saw for the first time the Acræid *Telchinia violæ*, reminding one on the wing of *Argynnis euphrosyne*; it was locally abundant and gregarious, its tone of colouring harmonizing with the red igneous rock. On the same hill were two or three *Precis œnone* and several small *P. orithyia*, while *Zizera otis*, Fab., was abundant.

In the course of this walk I noticed a Fakir, or religious mendicant ascetic, watching my operations with evident suspicion, probably owing to the reverence in which some of these folk hold all animal life. Presently a small native boy threw a stone at a squirrel. I thought better of the Fakir when he cursed the boy so fiercely that he fled in terror as fast as the squirrel, while I rolled up my umbrella-net and passed on, trying to elude observation!

Mozufferpúr, lat. 28° 8′ N., alt. c. 300 ft.

On a flying visit, January 2nd, 1904, to this place, nearly north of Bankápúr, I took in my host's garden two *Zizera otis*, Fab., and one *Zizera maha*, Koll.

Allahabád, lat. 25° 30′ N., alt. 370 ft.

Here on January 4th I saw a few of the very commonest Indian butterflies in the public garden. The railway carriage before leaving in the evening produced a grasshopper, *Atractomorpha* (*Perena*) sp., and *Prodenia littoralis*, a Noctua that came to light. This last proved tenacious of life, it laid a number of eggs in its paper which hatched on the voyage, the young larvæ perishing miserably.

Jhánsi, lat. 25° 30′ N., alt. c. 750 ft.

January 5th—13th, also 21st, 1904.

Situated on a sandy plain, broken by precipitous ridges of igneous rock, Jhánsi, something like 750 ft. above the sea, is characterized by dryness, heat, and sparsity of cover.

A couple of *Papilio aristolochiæ* taken at flowers near the lake were the sole representatives of their family.

Several *Belenois mesentina* were taken, but it was scarcely common; the male had a distinct but faint, sweet scent; on the ridge of Retribution Hill (where Sir Hugh Rose in 1858 slew 2000 mutineers), I took a female *B. mesentina* in which the hind-margins of the secondaries had been symmetrically broken off, probably by the bite of a lizard. Of three specimens of *Terias hecabe*, one, a small female, was of the variety without the "dog's head" notch. Of *T. libythea* a single specimen was taken, but *T. læta* was common and of gregarious habits. *Teracolus etrida* was locally rather common, especially the female. On the other hand, the male of *Ixias marianne* was rather common.

Two *Atella phalanta* were taken; the only *Precis* noted was *orithyia*, and that very dwarfed, one measuring only 1·4 inches across the wings.

Telchinia violæ was abundant at the foot of Retribution Hill, and scattered specimens occurred elsewhere. This insect, like the Danaids, has a tough skin which enables it to resist pinching, and doubtless makes it indigestible. When injured a yellow juice exudes; a minute drop of this placed on the tongue tasted somewhat bitter and disagreeable, but the flavour was by no means strong.

The Jhánsi Lycænids were fairly numerous, but not very brilliant, the most striking was *Chilades putli*, Koll., actually smaller and darker than our *alsus*; other species were *Chilades laius*, Cr., which appears to have been common, but of which I unfortunately took but one specimen, and *Catochrysops contracta*, Butl., of which I took two; *Tarucus theophrastus*, Fab., of which the two sexes are, on the upper surface at least, very different, was common, but of *T. telicanus*, Lang, I only secured one of each sex, though noting it as common. Blues are very abundant in India, but they are very much alike, so that being ignorant of the distinctions between allied species, one was but too apt to neglect them while in the eager

pursuit of larger game. For these reasons too much weight should not be attached to the observation that such and such a species was common or abundant, but the qualification, "or something superficially like it," should be added.

Two moths came to light, an Agrotid *Euxoa spinifera*, Hübn., and the *Macaria*-like *Semiothisa frugaliata*, Guen. I also took a brown beetle, *Bolboceras quadridens*, Fab.

After prolonged drought there was a heavy rainstorm at Jhánsi on January 14th, and there was slight rain at Gwálior on the 16th and 17th. With the exception of a *very* few days when there had been clouds and occasionally a *few drops* of rain, there had been almost uninterrupted sunshine for three months, *i. e.* since October 8th. On January 20th, writing to Dr. Dixey, I said, "There has been a very cold 'wave' in Northern India with a few showers of rain, but scarcely enough of the latter to affect either vegetation or insects." On January 23rd there was gentle rain at Jhánsi lasting several hours.

On January 21st I had another day's collecting at Jhánsi, but the species taken were not such as to show any effect in the way of change of type due to the rain, even if such change had been possible. The insects met with were *B. mesentina*, *I. marianne*, *T. etrida*, *A. phalanta*, and *Tarucus theophrastus*.

Orcha.

On January 9th I had an hour's collecting in this interesting deserted city, some eight miles to the east of Jhánsi, and took or saw *Limnas genutia*, *Precis lemonias*, *P. œnone*, and *P. orithyia* (this last in abundance), *Atella phalanta*, an *Ixias*, *Teracolus etrida*, a *Terias*, and several female *Belenois mesentina*. Monkeys were almost as common as butterflies among the ruined tombs.

Burwa Ságar.

On January 14th I got a couple of hours' collecting in the neighbourhood of the interesting and romantically-situated old castle of this name, which lies some twelve miles to the east of Jhánsi.

Here I observed in two specimens of *Limnas chrysippus* (of which certainly one was a male) a distinct cockroach-like odour, sufficiently strong to be perceptible when the

insect was fluttering in the net. Of *Catopsilia pyranthe* I took a female of the *gnoma* form; of *Terias hecabe* a male, the variety without the "dog's head" mark. *T. læta* was quite abundant. Two specimens of *Huphina nerissa* were taken, one worn, the other a dwarf. The male of *Belenois mesentina* was common, in two specimens I detected a sweet scent like that of *P. rapæ*, but more or less faint. A *Polyommatus bæticus* completes the list.

Ágra, lat. 27° N., alt. 550 ft.

January 25th and 26th, 1904.

At the sight-seeing centre of India there was but little time or opportunity for entomology. In the fair gardens of the Taj Mahal *Limnas chrysippus* was abundant, three or four *Papilio aristolochiæ* haunted the brilliant orange-coloured flowers of *Bignonia venusta*, and a few *Belenois mesentina* were flying around. In the Government garden close by I also saw the *Belenois*, together with *Huphina nerissa*, *Precis orithyia*, and *P. lemonias*, *Limnas chrysippus*, and *L. genutia*, also a *Teracolus*, and some Blues which escaped capture.

Fathipur Sikri.

January 28th and 29th, 1904.

At the abandoned capital of Akbar the Great, the Pompeii of India, some twenty-two miles west of Agra, those ruin-frequenting butterflies, *Belenois mesentina* and *Teracolus etrida*, were both common, but all appeared to be males. The *Belenois* had a faint, sweet, flowery scent, which did not appear to me to be quite like that of any other insect.

I also took one *Teracolus puellaris*, a female, and a most ferocious hornet, *Eumenes dimidiatipennis*, Sauss., a ♀.

Jáipur, lat. 27° N., alt. 1600 ft.

February 2nd, 1904.

The fine public gardens of the enlightened Máharájah are too well kept to be a good collecting-ground. *Terias læta* was however to be had there [as well as at the deserted capital Ambér, a few miles to the north and on higher ground]; those taken were males; a very small

Limnas chrysippus seemed to bear evidence of the prolonged drought. The genus *Papilio* was represented by *aristolochiæ*, and the Chrysid *Stilbum splendidum*, Fab., did its best to gratify the Rájpúts' love of brilliant colour.

Ajmir, lat. 26° 30′ N., alt. c. 1800 ft.

February 4th and 5th, 1904.

The most notable capture here was *Teracolus fausta*, Oliv., of which I only got one male, a poor specimen, missing two others; it has a very distinct orange look on the wing, and I feel sure that I saw one on January 22nd at Pálipahári, the artillery camp near Jhánsi.

Of *T. etrida* I took two males, one of them had lost the apex of the left fore-wing and all its hind-margin, as well as the apex of the left hind-wing. This is notable as possibly being an attack on a "direction mark."

I saw several battered *Precis œnone*. The smaller fry were represented by a very neat little chequered Skipper, *Hesperia galba*, Fab. The emerald-like *Stilbum splendidum* again turned up.

On Taragarh, the precipitous hill that overtops the city by perhaps 500 ft., I got only *Belenois mesentina*, *Terias læta*, and the long-waisted ♀ wasp, *Eumenes dimidiatipennis*, Sauss.

Mt. Ábu, lat. 24° 30′ N., alt. of civil and military station c. 4100 ft.

February 6th—8th, 1904.

Insects were extremely scarce upon the sacred Jaina mountain. The commonest butterfly was *Terias læta*; it was abundant up to 4500 ft., and the only representative of the genus seen. These, together with *Belenois mesentina*, *Huphina nerissa*, a few *Precis lemonias*, and a couple of *tages*-like Skippers (which I missed upon rocks at about 4400 ft), were the only butterflies that I saw on the elevated plateau. One moth, the very widely-distributed Crambus, *Eromene ocellea*, Haw., came to light.

At lower elevations, on the fine road up from the plain, the following were met with: at about 3000 ft., *Belenois mesentina*, *Taracus telicanus*, and *Polyommatus bæticus*, the last as usual in poor condition. From 3500 ft. down to

2500 ft. a few *Yphthima inica*, Hew., were seen, and at about the last-named elevation, among the rocks of a nearly dry water-course, I saw two specimens of the beautiful Nymphalid, *Symphædra thyelia*, Fab., but only secured one. It has the habits of a *Vanessa*; unfortunately time was pressing, or I might probably have taken more.

Bombay, lat. 19° N., near sea-level.

February 10th, 1904.

In an hour's visit to the Victoria Gardens, where there were a fair number of insects, I got *Papilio erithonius*, *P. aristolochiæ*, *Neptis varmona*, and *Nepheronia hippia*, a female, the last named mimicking *Tirumala*.

On February 15th I was much interested in watching the movements of a solitary butterfly in the small public garden of the University, in the heart of the city. It appeared to be a large *Catopsilia*, possibly the *catilla* form of *pomona*, but at any rate of a general greenish-yellow colour; when disturbed it invariably settled in one or other of several small shrubs with yellow leaves, when it would vanish quite suddenly. It was only after several attempts that I succeeded in getting a glimpse of it when settled, so strong was the protective resemblance.

Bijápúr, lat. 17° N., alt. c. 1500 ft.

February 16th and 17th, 1904.

This was further south than I had yet collected, but the scanty vegetation among the ruins seemed too parched to yield very much. The most prevalent genera here, as at so many places where thorns, burrs, rocks and ruins predominated, were *Belenois* and *Teracolus*, the last a genus which, though beautiful in the cabinet, is not effective on the wing.

Teracolus etrida was abundant, the males appearing to be about twice as numerous as the females; they varied greatly in size, so much so that among the males the largest had nearly double the alar expansion of the smallest. Of *T. dulcis* I took one female, and of *T. amatus*, var. *modestus*, two males.

The only *Terias* seen was *læta*. *Belenois mesentina* was abundant; a slight sweet scent was detected in one specimen.

Catochrysops strabo, Fab., was common, also *Polyommatus bæticus*, one specimen having lost two-thirds of each hind-wing, presumably the work of some enemy; of *Zizera karsandra*, Moore, I took one.

At night several moths came to light, viz. the Ocneriad, *Enome detersa*, Walk., the Geometers, *Tephrinia disputaria*, Guen., and *Idæa fibulata*? Guen. (worn), and the very widely-distributed *Etiella zinckenella*, Treit.

A ferocious-looking spider, a *Solpuga*, shared the Dák Bungla with us.

Anantápúr, lat. 14° 30′ N., alt. c. 1500 ft.

February 18th—23rd, 1904.

This small civil station, situated on an irrigated though elevated plain devoted to the growing of cotton and rice, is typical of Southern India.

A very hot walk to some small granite hills on the other side of the lake produced little beside two males of *Ixias marianne*, and a solitary *Teracolus eucharis*; the hills seemed too hot, dry, and parched to harbour butterflies.

About the trees along the dam, or "bándh," were a few *Hypolimnas misippus*, males, and abundance of *Papilio aristolochiæ*.

In the cotton fields by the river *Hypanis* [*Biblia*] *ilithyia*, Dru., was to be got, but not plentifully.

The best collecting-ground was a very weedy nursery garden and orchard. Here I one day had the advantage of the assistance of my host, Mr. Edwin Scott, I.C.S., whose keen appreciation of scents helped me greatly. *Limnas chrysippus* was abundant; of its scent Mr. Scott's first impression was "some sort of dung," then "a zoo"; later he said "possibly like a cockroach, but more like a musk-rat." The scent is, I think, general, but is perhaps stronger when the scent sacs on the hind-wings are opened: a fact that I also observed at Calcutta.

Crastia core was common and gregarious, frequenting a special mango-tree. When he smelt this insect Mr. Scott at once cried out "acetylene," adding that he would like to put a lighted match to it to see whether it would burn! Subsequent observations on the butterfly and the gas convinced me of the accuracy of his comparison. The genital organs appear to exude the scent, probably the long tufts appended to them.

At this place I confirmed in two specimens of *Catopsilia pyranthe* the jasmine odour connected with the "scent tufts" of the male, but did not find it as strong as in specimens of the same species examined at Bankápúr six weeks before. Mr. Scott agreed to the comparison with jasmine, but thought the scent was perhaps even more like that of *Polianthes tuberosa.*

I also examined two males of *Tirumala limniace* for scent, but was unable to elicit any from the prominent sacs on the under-side of the hind-wings, although I suspected some to be emitted by the genital tufts.

Papilio erithonius was frequently met with, and *P. aristolochiæ* was common, but I only took a single *P. pammon.* Although the male of *Hypolimnas misippus* was fairly common, I only saw one worn female; this was of the very marked variety *inaria,* Cramer, in which the white marks near the apex of the fore-wing are entirely wanting, and the black tip is reduced to a narrow border, so that it closely mimics *L. chrysippus,* var. *dorippus,* Klug., a form that is very rare in India. I several times saw the male *H. misippus* reconnoitring *L. chrysippus* as if in doubt as to its identity!

Of *Precis œnone* I took but one, of *P. almana* two, but *P. lemonias* was common. Of the following species I took mostly single examples:—*Limnas genutia*; *Ergolis ariadne*; *Neptis varmona*; *Polyommatus bæticus*; *Lampides celeno,* Cr., form *conferanda,* Butl.; *Catochrysops hapalina,* Butl., two; *C. strabo,* Fab.; *Zizera otis,* var. *indica,* Murray, two; and the Skipper, *Suastus gremius,* Fab.

Of *Melanitis ismene* I took but a small fraction, for one seldom sees a butterfly so battered, yet even this fraction was found in the shade. In marked contrast are the habits of *Telchinia violæ,* since it haunts the most sun-scorched places; it was not uncommon at Anantápúr, but if gregarious, as elsewhere, then I did not hit upon its head-quarters.

I took one *Terias libythea,* and saw several *T. hecabe,* though it was but moderately common.

Hovering at flowers I two or three times saw, and once caught, *Cephanodes hylas,* L., an insect very like *Sesia bombyliformis,* Esp. There were also flying in the sun *Deiopeia pulchella* and *Trigonodes hyppasia,* Cr., a Noctua very like *Hydrelia unca,* L., which reminded me of Headington and old Oxford days.

Out of the grass I kicked up *Tephrina catalaunaria*, Guen., a pretty little Macariid Geometer *Semiothisa subalbitaria*, Swinhoe, and *Sterrha paullula*, Swinhoe. The common dragon-fly, *Orthetrum sabina*, Dru., and a bug, *Eysarcocoris guttigera*, Thunb., completed the tenants of the garden.

A number of things came to light, viz.:—*Dciopeia pulchella*, the Ocneriad, *Enome detersa*, Walk., a Noctua, *Ericeia inangulata*, Guen., a Pyrale, *Schœnobius bipunctifera*, Walk., and a tiny Quadrifid Noctua *Raparna lactea*, Swinhoe, as well as two bugs, *Acanthaspis apicata*, Dist., and *Dieuches uniguttatus*, Thunb., the former apparently a scarce insect since the national collection contains the type only. There was in addition to these a small ochreous narrow-winged Geometer to which I have not been able to assign a name, and an ichneumon, *Henicospilus*, sp. In fact one evening swarms of insects came to light, including many mosquitos, but these appeared to be all *Culex*, fortunately no *Anopheles*.

Bangalúr, lat. 13° N., alt. 3100 ft.

February 23rd, 1904.

The change of trains at this large military station gave me an hour or two's collecting in the extensive public gardens. There was rather a high wind which was against a good day, but the afternoon proved interesting since it gave me the first glimpse at the "Ceylon" fauna. Here I saw for the first time that very striking black, white, and orange Lycænid, *Talicada nyseus*, Güer., as well as the huge and magnificent *Papilio polymnestor*, Cram. [*parinda*, Moore], a truly gorgeous monster in which a pale lilac is the prevailing colour trimmed with black.

The only other things noted were more ordinary, to wit *Catopsilia pomona*, a female, *Crastia core*, several *Telchinia violæ*, *Nychitona xiphia*, an abundance of *Neptis varmona*, and one *Neptis jumba*, Moore.

The Nilgiris, lat. 11° N.

February 24th—March 3rd, 1904.

The Nilgiris, or Blue Mountains, rising abruptly from the plain, itself nearly 2000 ft. above the sea, form a

rolling table-land with an average altitude of from 6500 ft. to 7500 ft. This plateau consists for the most part of grassy downs with here and there "sholas," or thickets of mixed growth, very beautiful at this time of the year owing to the red colour of the young leaves of the preponderant tree. Unfortunately, alike for the entomologist and the artist, these "sholas" have been largely cut down to make way for the extensive Government plantations of eucalyptus, which are by comparison dreary and monotonous.

On the way up the cog-wheel railway I saw on the side of the cutting two beautiful blue-green Papilios, which may have been either *P. telephus*, Feld., or *P. teredon*, Feld. At about 4500 ft. I netted a *Neptis varmona* from the train in motion.

It was evidently too early in the year to get many butterflies at Útakamand, the elevation making the nights cool, so it was necessary to seek out sheltered flowery banks facing south, or preferably south-east. In two such spots within a very circumscribed area *Talicada nyseus* was common; a single example also occurred [along with the inevitable *Pyrameis cardui*] on the grassy top of an isolated and exposed peak of about 8000 ft. This Lycænid is quite typical of "South India and Ceylon"; it is a conspicuous insect on the wing, its tricolour of black, white and orange-red, which should delight German entomologists, making it look larger than it really is.

Terias hecabe was rather common, but worn. A female *Lycæna bætica* and several *Pyrameis indica* were also old friends, and the same applies to two or three *Papilio aristolochiæ* seen at flowers in the hotel garden, the latter a good deal the worse for wear.

A few *Yphthima chenui*, Guér., occurred at about 7800 ft., the only *Satyrid* I met with at Útakamand. *Ganoris canidia* flew up to 8000 ft.; a male had a distinct smell like that of our *Pieris rapæ*. I submitted the living butterfly to my daughter and her lady friend, who both noticed the scent, though unable to describe it. When mignonette was suggested for comparison they both said "No"; but when sweet-briar was mentioned they said it was like that, my daughter speaking the more confidently of the two.

At about 7400 ft. I took a female *Catophaga paulina*, and also a fine female of *Hiposcritia narendra* [Moore], quite a

Ceylon species. The specimen is labelled "flies fast: rather common from 7400 ft. to 8400 ft." It is but too evident that I had not recognized that I was catching anything out of the common, and it is more than probable that I confounded the females of *Catophaga* and *Tachyris* with *Hiposcritia*, so that I am not by any means disposed to trust the statement that *H. narendra* was common then and there. One necessary consequence of my complete ignorance of the Indian fauna was that I did not know what was most worth catching. These white butterflies are as a rule by no means easy to catch and were often in bad condition, but in each locality I used to endeavour to secure one or two good samples. Doubtless the *Hiposcritia* passed for a very fine *Tachyris*.

Amongst herbage *Mecyna polygonalis*, Hb., was often kicked up, having much the habits and appearance of my old Bermuda and Mortehoe friend *Stenopteryx hybridalis*, Hubn. (*Nomophora noctuella*, Schiff.), which too was fairly common in exposed situations at about 8000 ft.; at a similar elevation a single example of the Danaid *Badacara nilgiriensis*, Moore, was taken.

Above the Botanic Garden on the road to Dodabetta, at about 8000 ft., I several times saw, but missed, *Vanessa charonia*, Dru., a butterfly that looks dingy in the cabinet, but on the wing looks much brighter and bluer than would be expected. It is sometimes called the Blue Admiral (completing the trio), though in truth it is much more like a tortoise-shell. *Argynnis niphe* was common at the higher elevations, and in exposed situations up to 8500 ft., reminding one of *A. aglaia*, L. It flew up and down the roads, returning again and again to the same spot.

The commonest and most characteristic butterfly of Útakamand was the pretty little *Colias nilgiriensis*, Feld., which was seen coursing over the grassy downs from 7300—8600 ft. Its flight is moderately fast, but quite close to the ground. It was somewhat startling, but in a way refreshing, to come across this Arctic survival so far within the tropics, associated moreover with species characteristic of Ceylon. As it was especially abundant in the hotel garden I took the opportunity of examining five males for scent; in two cases I suspected the existence of a slight scent, but in the remaining three the result was negative.

From Útakamand I moved to Konúr, which stands on the southern edge of the plateau, overlooking the plain.

It is at about 6500 ft. above sea-level, or 1000 ft. lower than Útakamand. At this elevation *Colias nilgiriensis* was not nearly so common as at the higher levels.

Worn *Pyrameis indica*, a few *Neptis varmona* and *Precis iphita* turned up here and there. Of a pair of *Terias hecabe* taken *in copulâ*, the male proved to be of "intermediate dry," the female of "pronounced dry" type. Opportunities of noting the pairing of the several forms occurred very rarely. Here I secured one specimen of *Yphthima ceylonica*, Hew., another foretaste of the great southern island. *Y. inica*, Hew., turned up at about 5800 ft., but at about 6500 ft., in a clearing in a wood, I found *Y. hübneri*, Moore, together with *Y. chenui*, Guér., and *Y. philomela*, Joh. There were swarms of these *Yphthimas* on that sunny bank, but as I did not distinguish the species at the time I cannot now say of what the bulk of them consisted. Some of the specimens have injuries to the wings, which from their shapes *may* have been inflicted by birds, but I attach little importance to them, especially as the injuries are unilateral, since the wings of *Yphthima* (and to a somewhat less degree of *Mycalesis* also) are so fragile that quite unbroken specimens are exceptional.

The genus *Papilio* was represented by a couple of *crithonius*. As usual *Argynnis niphe* showed a preference for lofty and bare places. On one occasion I watched a female of this species for some time under the impression that it was *Limnas chrysippus !* The resemblance on the wing is greater than might be supposed. *Vanessa charonia*, Dru., which had before eluded me so often, fell a victim at last; I secured two specimens on a shady road through a wood. It settles on rocks or walls, a habit that makes it hard to net, moreover it is shy and easily disturbed, though usually coming back again to its resting-place.

Stenopteryx hybridalis was common in grassy places, and I took the Boarmid *Bilactis inceptaria*, Walk., flying in the hotel garden at dusk.

It was tantalizing to be told by the hotel manager at Konúr of the immense number and variety of butterflies there in the summer. I was, however, fortunate in making the acquaintance of a dealer, named Solomon, a coloured man, who told me that at that time of the year it was no good collecting on the high ground, but for a consideration he agreed to show me a very good place

near the foot of the hills. Accordingly I went with him on March 2nd, and again alone on the following day. This involved travelling by an early goods-train to Kallár, the first station on the mountain railway above Mettupálaiyam, about 2000 ft. above the sea, but only 200 ft. to 300 ft. above the plain. Here, as in other parts of India, the best places for insects, at any rate in the winter season, are to be found in the belt of jungle at the foot of the hills, or in the woods on their lower slopes. But it is just in these places where the dreaded *Anopheles* is as abundant as the Rhopalocera, and the station-master at Kallár told me that entomologists always slept at Konúr and went up and down by train to avoid the nocturnal terrors of the deadly malaria—the tiny, innocent-looking *Anopheles!*

The collecting-ground was various, and included, besides bushy jungle with plenty of flowers near the station, large irrigated banana and betel-nut plantations as well as the bed of the river with its bordering woods.

The first thing to catch the eye was *Papilio hector*, L., and very magnificent he looked fluttering at the flowers of *Lantana* in his crimson-and-black suit set off with white. This is indeed one of the most striking butterflies that I met with in my travels, with its wings expanding four inches and upwards. It proved to be distinctly common, but one does not get within reach of every *Papilio* that one sees, nor indeed does one succeed in netting all that are struck at. *P. hector* was accompanied by plenty of *P. pammon* and a few *P. aristolochiæ*. One of the *P. hector* brought home is remarkable for the fact that the whole of the tips and half the hind-margins of both hind-wings have apparently been bitten off, almost absolutely symmetrically, by some foe. If the red spots on the under-side be really "warning marks" this is the more noteworthy.

A boggy, but sunny, corner of an irrigated banana-garden produced single specimens of the fine Skippers *Tagiades atticus*, Fab. [? = *T. menaka*, Moore] and *Tagiades distans*, Moore.

This same garden and the adjoining plantations of betel-palm (*Areca catechu*) yielded a few *Melanitis ismene*, a fair number of *Mycalesis perseus*, Fab., as well as *Yphthima marshalli* and *Y. philomela*, Joh. [= *baldus*, Fab.]; there was also abundance of the pretty and very distinct *Yphthima ceylonica*, Hew., with its silvery-white

hind-wings, which tried, not without occasional success, to pass itself off as a Blue. A few hasty observations on this species when at rest failed to detect any such "list" as is common in many members of the family.

I sent home two specimens of *Mycalesis perseus*, one an ordinary example of the dry-season form in which the ocelli are indicated by faint dark dots, the other (unfortunately very tattered) in which the full complement of ocelli on the under-surface is indicated by conspicuous chalky-white spots of varying sizes, to wit, two large and one small on the primaries and two large and five small on the secondaries. Three of these spots are faintly visible on the upper-surface. There are no rings and no pupils to the spots. It would appear to be a unique aberration of the dry-season form. In the shade along with the above Satyrids was the inevitable *Nychitona xiphia* and a solitary male *Elymnias undularis*.

A weedy neglected field near the river yielded besides *Limnas chrysippus* and *Atella phalanta* plenty of the "orange-tip" *Ixias marianne*, as well as a smaller number of the more gaudy *Ixias pyrene*. One proved to be a worn specimen of the female lacking the orange tip, a distinct and well-marked variety; another was of the racial form *cingalensis*, Moore. The "whites" *Huphina nerissa* and *Catophaga paulina* were in plenty. A single *Catopsilia pomona* was netted, a somewhat papery-looking insect, especially on the under-side, also several *C. pyranthe* of the "transitional *Gnoma*" form. In one of the latter (a male) I detected a faint scent, but less like that of jasmine than in the *Catopsilias* examined at Anantápúr. In the same field *Telchinia violæ* was abundant, while *Eryolis ariadne* was, as usual, common among *Ricinus*.

But all this time Solomon was most anxious to get me down to the river. This is a rapidly-flowing stream, occupying perhaps half its bed, and having on either bank sloping woods of mixed growth. Solomon sought out a place where a tiny tributary emerging from a rushy swamp trickled over the damp sand. He forthwith stuck into the wet sand a foot or so from the rill and well clear of the herbage, three or four large butterflies of which he had netted worn or broken specimens; then he stood by to watch. Nothing much happened, for unfortunately clouds had come up and the afternoon was only partly sunny, whereas to get many things at water, whether decoys be

used or not, it needs, as Solomon put it, to be "plenty hot." It was indeed hot enough for most Europeans, but not up to the exacting butterfly standard. However, next day the conditions were more favourable, and I found near what was left of Solomon's decoys a number of "whites" and "orange-tips." Accordingly I put down a few more decoys and walked away. After spending some time in vain endeavours to catch the conspicuous *Hebomoia glaucippe*, L.—giant of orange-tips—which was careering wildly about in all directions, I returned to the decoy-place and sat down just within the reach of my six-feet net-stick. *Catophaga paulina* were there in abundance, but all males, mostly sitting quite close together, almost touching, with wings erect so that the "hook-tip" of the fore-wing was very conspicuous; in another cluster close by were from six to eight *Ixias marianne*.

It will perhaps give some idea of the numbers when I say that I quite easily netted five *C. paulina* in one swoop, and seven in another.

Then *Hebomoia glaucippe* came along, reconnoitred the position with great circumspection, and settled warily for a second or two, but darted swiftly off at the least movement on my part. Nevertheless, with care and patience, I managed to secure a couple of specimens. My old friend *Papilio erithonius* came next and soon settled down a short distance away from the "whites," he was shortly followed by another and yet another: they all settled close together, within a hand's-breadth, forming an exclusive community and continued to drink steadily. All at once a blue-green flash, and *Papilio telephus*, Feld., sailed close past me; again and again he came, and finally, looking askance at the vulgar assemblage of "whites" and "orange-tips," settled quite close to the *P. erithonius*, evidently preferring their more select company. This occurred several times. *P. telephus*, when settled with wings erect, displayed an unexpected beauty, for, in place of the ebony and emeralds on the upper-surface, it shows beneath nothing but sheeny mother-of-pearl picked out with tiny rubies. By patient watching and judicious swooping I secured three specimens, and, be it remembered, these were all I saw that day. So much for water; what share the decoys had in my success it is hard to say, but Mr. E. E. Green, of Peradeniya, told me that decoys were efficacious, and Mr. Denton, of Regent Street, says that he has used even paper decoys with success.

The congregation of butterflies at damp sand was observed by Bates on the banks of the Amazon in 1849. He noted that they were all males, mostly of the genus *Callidryas.** Indeed Sir J. D. Hooker had the year before noted butterflies sitting on damp sand "in thousands" in the Ranjit valley, Sikkim.†

Mr. E. André noted a similar thing in Venezuela in 1897, where the attraction was the foul mud of a farm-yard: the butterflies were chiefly *Callidryas*, with some *Heliconius*, *Papilio*, *Metamorpha* and *Cœrois*. He says: "Each species tried to herd with its own kind," but he says nothing as to sexes. There is a capital photograph in his book of a group of *Callidryas*.‡

Doubtless this habit of butterflies is well known to all tropical collectors. I myself in Germany some 35 years ago, noted swarms of Blues at small puddles in the road—several species together, including, so far as I could see, *L. alsus*, *L. arion*, and *L. bætica*. A few days afterwards near the same place and similarly occupied I caught *Apatura iris* in my hat! This summer at Mortehoe, on the 1st of August, in the early afternoon, I saw 14 or 15 *G. napi* sitting close together on wet mud; they were all males.

A piece of waste ground adjoining the plantation of the singularly graceful *Areca* palms, covered with *Lantana* in full bloom, was crowded with butterflies such as *Crastia core* and *Narmada coreoides*, Moore, one or both of which (for I did not distinguish them when alive) was abundant; several *Neptis varmona*, and two or three *Nepheronia ceylonica*, Feld., another southern species. More striking than all these were the swarms of *Tirumala limniace*, a big and handsome black and bluish-white Danaid, which I found all over India but never saw elsewhere in anything like such numbers as on that mass of *Lantana*.

Other things that turned up in the course of the two days' collecting were *Tachyris hippo*, two; *Teracolus etrida*, one; *Hypolimnas bolina*, two males; *H. misippus*, one male; *Precis iphita*, common; *Caprona ransonnettii*, Feld., one; *Parnara mathias*, one; *Castalius rosimon*, and plenty of *Lampides celeno*, Cr., including the form *conferanda*, Butl.

Of the above the fine Skipper, *Caprona*, was seen to settle, in full sunshine, on the *under-side* of a leaf, with its

* "Naturalist on the Amazons," 1st edn., p. 249.
† "Himalayan Journals."
‡ "Naturalist in the Guianas," p. 142.

wings fully expanded like a Geometer. I do not ever remember seeing a butterfly do this before, but then we are perhaps wrong in calling Skippers butterflies. One of the *Lampides*, a female (?), was found settled close to the ground, with all its wings erect as usual and close together; it was however moving its hind-wings alternately, in a rhythmical manner, *in the plane of the wing*, about 10–15° forward and then back. No other specimen of the species was near it.

On the occasion of my first visit to Kallár, as we were walking back to the station, Solomon suddenly darted off like the wind, and I found that he was after a very large *Papilio* which he had caught sight of flying about a puddle in the road, some hundred and fifty yards off. He waited long and patiently until it settled to drink and then popped his net over it. It was *Papilio polymnestor* in splendid condition, black and French grey, 5½ inches in expanse! This haughty beauty was not kind to me at Kallár; many a time I caught a glimpse of her flying about in a supercilious sort of way, but she never gave me a chance of closer acquaintance. Solomon had the advantage of me in many ways, first and foremost in years, next in his keen sight, but he was also wily and skilful with his net. During the day he took among other things a specimen of *Papilio agamemnon*, L., a fine black-and-green fellow that I too had seen; also one of that grand diamond-beetle green butterfly *Papilio crino*, F., which I missed the next day at *Lantana* flowers, as I believe, through sheer excitement!

Trichinápali, lat. 10° 50′ N., alt. c. 400 ft. or less.

March 4th and 5th, 1904.

My collecting here was almost confined to the banks of an irrigation canal, where the genus *Papilio* was represented by *P. hector*, *P. pammon*, and *P. aristolochiæ*, of each of which I saw several.

Limnas chrysippus was common; in the male of *Tirumala limniace* I detected a very faint scent, suggesting old cigar-boxes.

Catopsilia pyranthe was rather common, the specimen preserved was of the intermediate form; I noted a scent in the male, but it was not so strong as in some of the Bankápúr specimens. Of *Delias eucharis* I took two

females, by far the less common sex, at all events in collections. Of *Huphina nerissa* I took one of each sex. *Terias hecabe* was abundant.

The most striking fact about the butterflies of Trichinápali was the predominance of the genus *Teracolus*; of these I met with three species: *T. eucharis* was in abundance, but I find my specimens comprise eight males to two females; of *T. etrida* I took two males; and I was greatly delighted to see here for the first time that truly exquisite little gem the crimson-tipped *T. danäe*. It proved to be rather common, and I secured two of each sex. It is one of the most "elegant flies" that I have ever seen alive.

Precis orithyia was common, the specimens small and brilliant; *P. lemonias* was in larger numbers than I met with anywhere else, in fact quite abundant; *Ergolis ariadne* was common; I netted a pair of *Hypanis ilithyia in copulâ*, one was of the "wet-season" form, the other "intermediate" tending to "wet." As usual *Telchinia violæ* was common.

I took here one specimen of that beautiful Lycænid with the under-side striped like a tiger, *Spindasis vulcanus*. This is one of the butterflies with an anal lobe to the secondaries, but unfortunately I had not an opportunity of observing it at rest. *Lampides celeno*, Cr., was common; some smaller and dingy Blues were abundant, *Zizera otis*, Fab., var. *indica*, Murray, and *Chilades varunana*, Moore, thought by De Nicéville to be the wet-season form of *C. laius*. I also took one specimen of a small bright golden Skipper, *Ampittia maro*, Fab.

Tanjúr, lat. 10° 47′ N., alt. 350 ft. or less.

March 6th, 1904.

The predominant genus of the plains of Southern Madras would appear to be *Teracolus*, which was represented in my envelopes from Tanjúr by a male *T. etrida*, a pair of *T. eucharis*, and five males and two females of my favourite crimson-tip, *T. danäe*, which was quite common.

Of *Catopsilia pyranthe* I took a dwarf male of the intermediate form. *Terias hecabe* was common, and I took a very large female [over 1·8 inches in expanse, it was

"dry"]. Single specimens of the following were sent home: *Nychitona xiphia*; *Papilio pammon*, male; *Limnas chrysippus*, female; *Castalius rosimon* and *Lampides celeno*, Cr., of the form *conferanda*. *Telchinia violæ* was common, one being of a fine red colour.

Mádura, lat. 9° 55′ N., alt. 600 ft.

March 7th, 1904.

This was about the least productive place that I visited. *Limnas chrysippus* was scarcely common. A male *Huphina nerissa* gave out the sweet-briar scent quite strongly. I saw several *Telchinia violæ* upon a railway bank. *Precis œnone* was fairly common, but *P. almana* was commoner here, about the irrigation ditches bordering meadows, than at any place I visited; they were of the "intermediate dry" form. *P. lemonias* was also abundant, some of them being very brightly coloured.

In a grove of young palms near the river a singular dragon-fly, *Libellula variegata*, Linn., was common; the tips of its wings are transparent and colourless, but the basal three-fifths of the primaries, and the basal five-sixths of the secondaries, are light-brown with a bold dark-brown pattern. I believe that I saw the same creature in the Kudsia Gardens at Delhi, flying near the tops of trees, and then, as in the present case, took it for a *Heliconius*-like butterfly, which it greatly resembles on the wing. As I did not know that any butterfly of that shape was found in India I was greatly excited at seeing it, and proportionately disappointed when I at last effected its capture.

This was the last place at which I collected in India.

Ceylon, lat. 7° N.

All the places that I visited in this beautiful island were within twenty miles north or south of the seventh parallel of latitude. The luxuriance of the vegetation was an immense relief after the parched plains of India. At the lower elevations it was more distinctly tropical than any that I had yet seen, but this character was lost at greater altitudes.

Peradeniya, alt. c. 1200 ft.

March 10th, 1904.

These justly celebrated gardens lie about four miles south of Kandy near the centre of the island. Their situation is beautiful and all the familiar "hot-house plants" grow luxuriantly. Splendid palms of many kinds, huge bamboos almost as tall, *Dracænas*, *Crotons*, *Acalyphas*, *Marantas*, nutmeg, cinnamon, camphor, huge trees of *Ficus clastica* with roots spreading far over the surface, etc., etc. Grass has been largely ousted by the sensitive-plant, *Mimosa pudica*, which, introduced from South America, has run wild. It grows about a foot and half high, and when one walks through it a broad path is left owing to the collapse of the leaves.

Here, well out of reach, I saw my first *Ornithoptera*, truly it is well named; I missed a second specimen through sheer excitement. Several *Catopsilia pomona* were netted, one was a female verging on the *catilla* form, the others were typical males, one of which had a slight scent. Of three male *Terias hecabe* two were wet-season, the other of "intermediate wet" form. A male *T. libythea* was also of wet-season type, a female was also taken. The only Nymphalids noted were two *Neptis varmona* and several *Precis iphita*. Here also I took my first *Parantica ceylonica*, Feld., a Danaid found in abundance later.

Of *Mycalesis mandata*, Moore, I only saw one, but the pretty little *Yphthima ceylonica* was swarming amongst the sensitive-plants. Mr. E. E. Green, the entomologist to the Ceylon Government, suggested that its colouring might be indirectly protective, since on the wing it looks much smaller than it is, only the white posterior two-thirds of the hind-wings being conspicuous, and these the least vitally important to the insect. The only Blue seen was *Zizera karsandra*, Moore.

A second visit to the gardens, rather late one afternoon, produced no insects, but gave me my only sight of a wild cobra, about 2½ feet long, with a very large "hood"; it crawled quickly away into the roots of a "travellers' palm."

Unfortunately for me Mr. Green was on the point of going to England on leave, but though busy with his preparations for departure, he was good enough to show me several very interesting things, such as larvæ of the

leaf insect, young snakes, etc., and above all he gave me some very useful advice. Peradeniya, he said, was not as rich a locality as Kandy; and, as regarded the highlands of Ceylon, he told me that, at any rate at that time of the year, Lepidoptera were for the most part confined to certain favoured spots, which it was unlikely that I should hit upon. He therefore strongly recommended me to concentrate my attention on "Lady Horton's Drive" at Kandy.

Kandy, alt. 1500 ft.

March 11th—15th, 1904.

On the south side of the artificial lake at Kandy stand some low hills, covered for the most part with natural forests, through which have been cut a number of roads named after the wives of former governors. Lady Horton's Drive is one of these, which runs about half-way up the hill, winding around its southern and eastern slopes. A wide road, bounded on either side with forest of rich and varied tropical growth, lying fully open to the morning sun, commanding moreover a glorious view over groves of palms to the bluest of distant hills, it affords an almost ideal collecting-ground. The climate of Kandy, so far as I experienced it, is delightful, tropical heat tempered by elevation, and with a pleasant softness in the air, yet free from the excessive damp of many places within the tropics. Its vegetation is by far the richest that I had seen. My pleasure in collecting in this earthly paradise was greatly enhanced by the companionship of Mr. W. G. Freedley, junr., a Philadelphia gentleman who had been collecting butterflies in Borneo, Celebes, Japan, Macao, etc.

In such a locality it was perhaps to be expected that Pierines would not be dominant, at any rate so it was. By far the commonest of the family was *Catopsilia pomona*, of which the males were very abundant, but strong fliers and by no means easy to catch. We remarked that they usually all flew in the same direction, and that uphill. As the females were comparatively scarce one was not surprised to see more than once signs of jealousy on the part of the males. I detected a slight jasmine-like scent in the male on stroking the "scent tufts" on the hind-wings. A female *Terias hecabe* had apparently been bitten in both hind-wings when at rest, the injuries being

more or less symmetrical. *Delias eucharis* was scarce, *Catophaga paulina* more common. In one case I saw a bird try to catch a specimen of the latter on the wing; the bird missed its quarry, but I was more successful; it proved to be a male.

The Danaids were well to the front, the commonest species being *Parantica ceylonica*; it is smaller and greyer than *Tirumala limniace* and varies considerably in size, a small male measuring only 2·5 in., a large female as much as 3·4 in. across the wings. It was curious that this species became quite abundant late in the afternoons, as other things were retiring. I was surprised to find that a male when fluttering in the net gave out a strong scent like that of *Crastia core*, *i.c.* very like acetylene. This was noted in two or three specimens, and was quite unmistakable. *Danais septentrionis*, Butl., appeared to be rather common. A female has the hind-wings much broken, perhaps from the bite of a lizard, but the breakage is only in part symmetrical. *Limnas genutia*, of which I took a very small one, was very scarce, and I did not see *L. chrysippus* at all. The genus *Crastia* was represented by many individuals. I took five *C. asela*, Moore; of one of them I noted at the time, "has a scent as in *core*."

But the most prominent group of butterflies at Kandy was assuredly the *Papilionidæ*; I met with six species. The most remarkable was *Ornithoptera darsius*, Gray, peculiar, I believe, to Ceylon, an insect that I had greatly wanted to take; it appears to be fairly common, as I saw two at Peradeniya, seven or eight at Kandy, and two at Haragáma. It sails about somewhat slowly and in a dignified manner, looking very distinguished in its rich yellow-and-black livery and impressive by its size, five and a half to six inches expanse of wings! When it comes within reach it is not hard to catch, and I secured two males and a female, but it is a formidable-looking creature in the net, with a thorax suggestive of a Bombyx. Mr. Freedley told me that the males have a scent like sassafras, but I learned this too late for confirmation. The male *Papilio pammon* was common enough, one specimen was unusually small, measuring under three inches. Two specimens of *P. aristolochiæ* (a distasteful butterfly) were brought home; one of them has the tips of the hind-wings up to the tails bitten off quite symmetrically, thus much resembling the mutilated specimen of *P. hector* taken at Kallár. Of the tailless

P. dissimilis, L., I took three, but probably saw more, since it so very closely mimics *Tirumala limniace* or a large *Parantica ceylonica*, as easily to pass for one of those insects; it is indeed most easily distinguished from them by its habit of fluttering while feeding on a flower. One of my specimens has the anal angle and a great portion of both hind-wings bitten off in an almost symmetrical manner, suggesting the bite of a lizard. It should be noted, as was observed long ago by the President, that, whatever the cause may be, it is in the great majority of cases the *hind-wings* that suffer these injuries; doubtless the framework of the fore-wings is the stronger, but that does not seem to be a sufficient explanation, since from their greater length they must be more exposed to chance injuries from thorns and the like. Mr. Freedley took a *Papilio* that mimicked *Euplœa*, but I believe that *P. dissimilis* is dimorphic, one form mimicking each genus. Indeed it would appear that the name *dissimilis* implies that its bearer is like anything rather than a *Papilio*.

In a shaded glen down which a tiny stream and a foot-path strove for the possession of the ground, I took close to the water a faded specimen of my Kallár acquaintance *Papilio telephus*, and missed another that was drinking at the mud. But far more exciting than all the before-mentioned species was *Papilio polymnestor*, or as Moore has it, *P. parinda*, a truly magnificent fly that dashed about in all directions. It measures about $5\frac{1}{2}$ inches across the wings and is rendered most conspicuous by its colouring—French-grey and black. It rarely settled and was very hard to catch; Mr. Freedley and I were constantly striking at it, but it almost always eluded us. After many fruitless attempts I succeeded in netting two, one so battered that its powers of flight were seriously impaired; Mr. Freedley was even less fortunate, probably because he had a very small net.

There was yet another *Papilio* which eluded me altogether. It was black-and-green and I feel pretty sure *P. agamemnon* [which I also missed at Kallár in the Nilgiris]. It had the extraordinary and most aggravating habit of flying up and down, or rather backwards and forwards, just like a sentry, over some small trees below the road. Its path, if one may so call it, was about a dozen yards in length, and it always turned round at the same place, moving by a succession of jerks. I once actually

watched it for twenty minutes so occupied, it then settled for a moment on a *Lantana* flower; I struck at it and missed, and the performance began again! Another day I saw it at its post as before. Of all the Papilios that I saw this species was by far the wariest.

In striking contrast to the Papilios in every way are the Satyrids. A single *Calysime* [*Mycalesis*] *perseus* [? = *medus*, Fab.] was a very dingy shade-lover. The bright little *Yphthima ceylonica* was abundant; so far as observed it sits upright. *Nyssanga patnia*, Moore, a very distinct species, with leaden metallic lines on the under-surface, was fairly common at the edges of woods, but I did *not* meet with it on the "patnas" or grassy plains of the highlands of Ceylon.

The Nymphalines met with included several interesting species, notably *Cynthia asela*, Moore, of which I saw a very fine example, but caught only a very tattered fellow. It seems to like sailing about over the trees. With *Cethosia nietneri*, Feld., I had similar ill-luck. Of *Cupha placida*, Moore, again I have but a very worn specimen annotated thus: "Has the swift flight and to some extent the habits of *Precis*, but is fond of resting on the leaves of trees." These remarks are probably intended for, or at least include, the allied *Cirrochroa cognata*, Moore, which was certainly common, though very local; one of my five specimens, otherwise in good condition, has *two* snips taken out of each hind-wing, symmetrically, but it appears to be an insect readily chipped. Both these species have fulvous wings with black tips, so they are readily confounded in the field.

Neptis varmona might be said to be abundant, while its ally, the brown-and-black *Rahinda sinuata*, Moore, was decidedly common. In this connection may be mentioned the Erycinid *Libythea rama*, Moore, which appears to mimic *Rahinda*. I secured one specimen at Kandy, and believe that I missed another in the Pashók tea-garden near Darjiling.

I saw no females of *Hypolimnas bolina* at Kandy, but took three males, one of which had lost both the anal angles of the hind-wings, the injury being in part symmetrical. *Precis iphita* was common, so was *P. atlites*, looking on the wing like a dingy *Neptis*; a new brood appeared on March 14th. *Eryolis meriones* was common.

The Lycænids were not well represented, but I saw

several *Loxura atymnus*, Cr., var. *arcuata*, Moore; as usual *Lampides celeno* was common, almost spangling in the sunlight, one specimen was so unusually brilliant as to recall *L. adonis*; *Talicada nyseus* brought up the rear.

The Skippers were represented by single examples of *Parnara mathias*, a dark fulvous *Iambrix salsala*, Moore, and the dingy *Spalgis epius*, Westw.

At rest on a fence outside the "Queen's Bath" I found one morning a fine Sphinx, *Meganotum melanomera*, Butl. A very distinct-looking Arctiid having a crimson body and light pink fore-wings, with a longitudinal fuscous streak, *Creatonotus interrupta*, Linn., came to light, as also did *Eupterote diffusa*, Walk., a Lasiocampid.

A few insects of other orders forced themselves upon me, busily occupied as one was, *e.g.* a very large, black ♀ carpenter-bee, *Xylocopa tenuiscapa*, West., with peacock-green wings; a very large, evil-smelling, brown bug, covered beneath with a waxy substance that during life glistened like silver, *Tessaratoma javanica*, Thunb. Another bug, *Chrysocoris stockerus*, L., was an intense metallic green with black spots; yet more conspicuous than any of these was the large Fulgorid *Hotinus maculatus*, Oliv., or so-called Lantern-fly, expanding three inches across the wings. Its fore-wings are black-and-white, the hind-wings light blue with a very broad black border. This was fairly common, flying high and settling on tree-trunks out of reach, but easily disturbed, when it flies off to a similar resting-place.

Haragáma, 11 miles S.E. of Kandy.

March 12th, 1904.

This appears to be locally recognized as a great place for butterflies; the collecting-ground is along the course of a rapidly-flowing stream with wooded banks, perhaps 500 ft. below Kandy, or say, 1000 ft. above sea-level.

Again, I had the advantage of Mr. Freedley's company on the occasion of my expedition. The first thing to catch our attention was *Hebomoia glaucippe* careering about in considerable numbers, but most unwilling to be caught.

The pretty little *Talicada nyseus* was literally swarming. I cannot remember ever having seen a Lycænid in such numbers. I repeatedly observed this butterfly settle with

its head upwards and immediately turn round so that its head looked downwards. This habit of resting with the head down is common, if not general, in the family, and has an obvious bearing on the protective use of tails, anal lobes, and directive marks.

Zizera otis, Fab., was also in abundance, and *Lampides celeno*, Cr., was common.

Tirumala septentrionis was not common, and the specimens netted were tattered males; one had a symmetrical injury near the anal angle of the hind-wings, possibly due to the bite of a bird. I saw a few specimens of *Crastia asela*, Moore, and secured two males, which exhibited the "acetylene odour."

Neptis varmona was common, and I took a specimen of the elegant Nyctemerid day-flying moth *Trypheromera nigrovenosa*, Moore, which seems to mimic it. Of the beautiful *Nepheronia ceylonica* I took one male. *Cirrochroa cognata*, Moore, was noted flying about a particular tree and did not appear to be attracted by flowers; I only saw it in that one spot, and the two taken were in poor condition. It is very like *Cupha placida*, Moore [= *Messaras crymanthis*, Stgr.], of which I took a fine specimen close by, at wet sand. I again confounded the two species as at Lady Horton's Drive. A few *Ergolis ariadne* and several *Nychitona xiphia* were seen. A male *Huphina nerissa* had the sweet-briar scent; a female was in fine condition.

At the furthest point reached in our walk, by a little bridge, two or three spots in the damp sand appeared to be very attractive. Besides the *Cupha* already mentioned there was *Ixias pyrene*, var. *cingalensis*, and *Papilio pammon*, the male, was rather common. [It was also seen flying about bushes, but not at flowers.] My Kallár friend *Catophaga paulina* was literally in crowds; they were all apparently males, sitting in dense clusters, their pointed white wings suggesting to me toy encampments. I easily netted ten at one swoop, while Mr. Freedley by a more cunning movement succeeded in getting as many as thirty-four into his net! In the same place I saw six or seven of the beautiful *Papilio telephus*, Feld., settled quite close together, and managed to secure three. It is a black-and-green species not easy to distinguish from *P. jason*, L.

The females of *Catophaga paulina* were common at flowers. One of the males, by the way, had a symmetrical injury to the *tips* of the hind-wings, but I can hardly see

how it could have been inflicted by an enemy without simultaneous injury to the fore-wings.

This day I saw two *Ornithoptera darsius*, one quite out of reach, the other I missed badly.

Hatton, alt. 4200 ft.

March 16th—18th, 1904.

In going up-country from Kandy when near Ullapáne station [alt. c. 2500 ft.] I caught, *from the train*, *Narmada montana*, Feld., and a little further on, c. 3000 ft., a male *Catophaga paulina*, a species that is very abundant in the Ceylon highlands.

Before Hatton is reached the line enters the tea country, whence the glorious primæval forests have disappeared, having been ruthlessly and completely cleared out to make way first for coffee and later for tea. Though doubtless "grateful and comforting," the tea-plant is most unpicturesque, only slightly surpassing the potato in that quality. The *Grevilleas* with their light feathery foliage, planted in regular rows to slightly shelter the tea from sun and wind, do but little to relieve its stiffness, and are a miserable substitute for the departed woodland glories. About Hatton there are but scraps of the forest left on the tops of the highest hills, and we were told that the tea-planters are constantly urging the Forest Department to allow these to be improved away. It results that what once was doubtless a grand entomological locality is now a very poor one.

Here for the first time I examined *Catophaga paulina* for scent, and was surprised to find that the three males tested had a scent nearly as strong as that of *P. napi*; it was described at the time as "like sweet-briar, but sweeter and more luscious," and I wrote to Dr. Dixey the same evening, adding "I had no doubt whatever."

About the hotel garden *Argynnis niphe* was common, a male had the fore-wings notably shorter and broader than usual.

A short walk in what is left of the old forest, towards the top of a high hill, say at about 4500 ft., produced several specimens of *Lethe daretis*, Hew., a regular sylvan Satyrid, repeatedly settling on the path, apparently always erect. Two of them have lost large portions of the hind-

wings near the anal angle, one symmetrically and in a way to suggest the bite of a lizard. On the under-surface of this butterfly the unusually large light-coloured scales on a black ground near the hind margin of the hind-wings are striking. In the same scrap of forest I took a single specimen of another species of the same genus, *L. drypetes*, Hew. [=*embolina*, Butl.]; also settled on a leaf of a tree far from the ground, as is usual with the genus, a *Limenitis calidasa*, Moore. Several *Atella phalanta*, a few *Neptis varmona* and *Terias hecabe* were also seen, a female of the last-named being of the "completely wet" form.

A specimen of *Cyaniris singalensis*, Feld., is very like our *argiolus*. With some difficulty I secured a specimen of the large black-and-white Skipper, *Celœnorrhinus spilothrys*, Feld. This is the second Skipper [the other being *Caprona ransonnettii*, Feld., at Kallár] that I have seen settle on the *under-side* of a leaf during *full sunshine*, the wings being expanded like a Geometer's. Another specimen was settled on a rock with its wings expanded in like manner.

In the hotel I found a fine Burnet (Syntomid) *Enchromia polymena*, Linn., at rest on a wall, it has slender black wings bearing orange spots, the body is blue, ringed and collared with scarlet; and in my bedroom took a beautiful little Tortrix-like Noctua, *Metachrostis incondita*, Butl., measuring only 17 mm. across the wings; also a most formidable-looking long-waisted wasp, *Eumenes petiolata*, F., a ♀, and *Pomasia psylaria*, Guén., a pretty little yellow Geometer with metallic markings, evidently attracted by light.

When coming down from Adam's Peak on March 18th, at the height of about 6000 ft., I saw several of the Lithosiid, *Asura uniformis*, Hmpsn., but in the rough scramble of the descent could only secure one; at about 4800 ft. were several *Talicada nyseus*, and a few hundred feet lower down I bottled two green beetles, somewhat resembling our Rose-beetles, but much more shiny, *Coryphoccra elegans*, Fab.

Nuwára Eliya, alt. 6200 ft.

March 18th—21st, 1904.

This Sanitarium is in some respects like Útakamund, it is situated on a grassy plain forming a basin among

mountains. The "patnas" or grassy areas are bounded by woods, which in their turn are fringed by somewhat stunted scarlet rhododendrons. At the best season it doubtless affords excellent collecting, but I found Mr. Green's statement, that I should be unlikely to light upon the good localities, amply confirmed.

I saw several *Papilio teredon*, Feld., flying about, and secured two that were drinking at wet mud. A female *Terias hecabe* proved to be of the wet-season form. Of *Neptis varmona* I took two. In a sedgy place surrounded by wood, a small "patna," I took the Skipper *Baracus vittatus*, Feld., curiously enough the only butterfly that I had taken in a swamp up to that date. The streaky markings of the under-side, following the veins, appeared when the insect was settled on sedge to be strongly protective. Of *Talicada nyseus* I saw several, the only other Blue seen was the *aryiolus*-like *Cyaniris lanka*, Moore, much battered.

Among moths I found one of the yellow Geometer *Corymica specularia*, Moore, at rest on a tree-trunk, and one Acidaliid *Idæa costata*, Moore. Also on Mt. Pederutalagalla, at about 8000 ft., the Skipper *Baracus vittatus* among sedgy grass and *Abraxas sordida*, Hmpsn., flying at dusk, nearly uniformly dark fuscous. This last is presumably a scarce insect since the British Museum possesses the type only.

Hakgála, alt. 4800 ft.

On March 19th and 21st I visited the beautifully-situated and well-kept Botanical Garden at Hakgála, some five miles south of Nuwára Eliya and at a considerably lower elevation.

Along the road *Catophaga paulina* was swarming, males with their sweet-briar-like scent appeared to largely predominate. They flew rapidly and always in the same direction, roughly speaking from south-east to north-west. They frequently flew in strings, just as if they were tied together, and reminded me strongly of the strings of floating stars that are dropped by a certain kind of rocket; I often saw three, four or five, and once even seven, so following their leader's every movement.

At a turn of the road close by the garden there was a

small patch of a tall, but small-flowered composite plant (of the Thistle-head sub-order); this plant did not appear to be common in the district, but it was especially attractive to a black Danaid, which was quite abundant within the limits of this plant's distribution. *Chittira fumata*, Butl., is very distinct and handsome on the wing, its flight is slow and it is easy to catch, but like all Danaids it has a tough integument and is very tenacious of life. The favoured flower was so attractive to the butterfly that it would even go into deep shade to visit it. *Chittira fumata* may be said to be gregarious; it has the "acetylene" odour of *Crastia core*, but not so strong and with a difference. I made no observation as to the relation of scent to sex in this species, which, by the way, I believe I missed at Hatton.

Near this same spot I took two *Crastia asela*, Moore, and saw others. I also got one *Danais septentrionis*, Butl.

The inevitable Lycænids were worn *Talicada nyseus*; *Jamides bochus*, Cr., one; and *Polyommatus bæticus*, which was common.

It was interesting to watch the pretty little honey-birds feeding at some tall spikes of flowers.

Horton Plains, alt. 7000 ft.

March 23rd, 1904.

This beautiful district gives one some idea of what Ceylon was before the era of tea-planting. Situated about 2500 ft. above the railway and approached by steep zigzag paths through rather poor woods, are extensive rolling plains of coarse grass, locally called "patnas"; these are surrounded by woods having a general temperate zone character, but with here and there an epiphytal orchid to remind one that the latitude is but 7° N. In the swampier parts of the patnas the devastating work of wild pigs was evident enough, while the paths through woods, and unmistakable droppings, proved that wild elephants had passed not many days before. It was however not the season for butterflies, the air being too exhilarating for their luxurious ways.

About half-a-dozen *Chittira fumata* were seen at elevations of 6000—7000 ft., mostly at their favourite

composite. On the patnas and among sedges in the woods were a few of the Skipper *Baracus vittatus*, they were not easy to see. I was surprised to come across no other butterflies on these patnas, which seemed the very place for such a Fritillary as *M. aurinia*, Rott., or such a Satyrid as *C. pamphilus*, L., or at least for a Blue, but no, even the eponymous *Nyssanga patnia* was not to be found.

In the woods I took two specimens of the beautiful *Lethe darcis*, Hew., and saw two or three others. They frequented shady paths and flew but a short distance, settling upon a trunk or branch, reminding me strongly of *P. ægeria* in my own garden at Mortehoe. The only *Argynnis* seen here (or indeed in Ceylon) was *A. niphe*; it was rather common in open spots in woods, the female looking on the wing very like *Limnas chrysippus*; a specimen taken, a female, had the apices of both hind-wings and the anal angle of both fore-wings symmetrically bitten.

Of *Terias hecabe* I found a few in a wood, of the intermediate dry form. *Neptis varmona* was not uncommon in the woods, as usual flying in a ghostly manner, and usually settling upon leaves of trees. In the same woods *Cyaniris lanka*, Moore, was common, but it was astonishing to see so few insects in such a locality.

Haputále, alt. 4500 ft.

March 23rd, 1904.

At this beautifully-situated Rest-house, overlooking the plain and the old Boer prisoners' camp, a great many moths came to light.

Owing to its large numbers the most prominent of these visitors was the small Noctuid, *Plotcia frontalis*, Walk., an extraordinarily variable species; another Noctuid was *Cosmophila xanthindyma*, Boisd.; there were two Deltoids, *Olybama lentalis*, Guen., and *Rivula basalis*, Hmpsn.; the Lymantriad *Dasychira inclusa*, Walk., and the extremely widely-distributed *Plemyria fluviata*, Hübn.

The formidable-looking beetle, *Xylotrupes gideon*, L., was an uninvited visitor to my bath-room.

On the same day an Acidaliid, *Idæa costata*, Moore, flew into my face in a tunnel near Ohiya station, alt. 5000 ft.

Colombo, at sea level.

March 25th and 26th, 1904.

Following Mr. Green's advice I went to the Museum and was well rewarded, though too pressed for time to reap all that I might have got by a more deliberate examination of the local collection of butterflies.

My collecting-grounds at Colombo were the Victoria Park, much exposed to the sea wind; the old Cinnamon Garden, said to be much worked for insects by the Museum "boys"; and the old Dutch Cemetery. None of these were very promising or very productive.

However, I saw here for the first time in Ceylon *Limnas chrysippus*; I also netted one *Parantica ceylonica*, and missed what I feel certain was a *Hestia*, probably *jasonia*, Westw., which is, I believe, common at Colombo.

Precis atlites was common in the Dutch Cemetery but worn, so was *P. almana*, nearly all of the wet-season form, *P. asterie*, L.; one specimen however was dwarfed and another was of the "dry" form with the ocelli rudimentary. *P. almana* would appear to be the more prevalent species in Ceylon and Southern India, where it replaces *P. orithyia*, so universal in the North.

I saw several *Delias eucharis* in the Victoria Park, and once more noticed their fondness for lofty flowering trees; those taken were males. In the same place I missed what I think must have been the *catilla* form of *Catopsilia pomona*; its congener *pyranthe* was common and I took two males. Once more *Telchinia violæ* was common, but of *Papilio aristolochiæ* I have only one to record. Of *Yphthima ceylonica* I took two.

Of the Blues there were several species; *Nacaduba norcia*, Feld., was very abundant and decidedly gregarious, it positively swarmed in Victoria Park, though good specimens were scarce. *Everes argiades*, Butl., var. *parhasius*, Fab., and *Zizera karsandra*, Moore, were also both of them abundant. I took also a single worn specimen of *Castalius rosimon*, Fab.

English is more spoken in Ceylon than in most parts of India, but the Cingalese appear more noted for fluency than accuracy; the inner meaning of the following apparently strange request of a lad is easy to fathom: "Master, buy some butterflies, ready-made." On getting back to the hotel from an entomological expedition one of

the messengers came up to me and said: "Missie told you to told me they had gone in."

An immature locust, *Truxalis nasuta*, L., taken in Victoria Park, completes the list of my captures in Ceylon, an island that I was truly sorry to leave and that will always occupy a treasured place in my memory.

Summary of Bionomic Observations.

Injuries by enemies.

Specimens of the following twenty-eight species were taken which appeared to present injuries caused by the bites of birds or lizards; save in the two cases specified the hind-wings had borne the brunt of the attack.

Tirumala septentrionis, two.
Cirrochroa cognata.
Precis lemonias, two.
Precis almana.
Hypolimnas bolina, ♂.
Hypolimnas misippus, ♂.
Pyrameis cardui (fore-wings).
Vanessa kashmirensis.
Argynnis niphe, ♀.
Yphthima hübneri.
Lethe darcis, two.
Curetis thetys.
Ilerda epieles.
Pratapa deva.
Polyommatus bæticus.
Colias fieldii.
Catopsilia pyranthe.
Ixias pyrene.
Terias hecabe, two.
Terias læta.
Catophaga paulina.
Ganoris canidia.
Belenois mesentina.
Teracolus etrida (fore-wings).
Papilio hector, *Papilio aristolochiæ* } red marks on hind-wings attacked.
Papilio pammon.
Papilio dissimilis.

It will be noted that this list includes no *Limnas*, but does include two *Tirumala septentrionis*, and two Papilios with conspicuous red "warning marks."

In Ceylon a bird was seen to make a swoop at a male *Catophaga paulina*, but missed it. I may here add that at Yokohama, May 19th, 1904, I saw a dragon-fly of moderate size, *Orthetrum japonicum*, Uhler, carry off a *Blanaida goschkevitschii*; this is a butterfly resembling a very large *Pararge megæra*; it did not appear to struggle at all.

Sideways attitude or "list" when at Rest.

In December, 1878, Col. C. T. Bingham noticed this resting attitude in a species of *Melanitis*, but the account was not published till many years afterwards.* E. H. A.'s papers in the "Times of India," which contained a reference to this habit in *M. ismene* (p. 203), reappeared as "A Naturalist on the Prowl" in 1894.

In the summer of 1903 Dr. Dixey and I noticed this habit in several British Satyrids at Mortehoe, N. Devon. In *Epinephele janira* the list may amount to 15°—30°; in *E. hyperanthus* (G. B. L., 1894) to 20°; in *Pararge ægeria* and *P. megæra* to 25°; but in *Satyrus semele* it reaches 40° or even 50°. This list may be to right or left in the same individual. The insects appear to settle in the upright position, then to draw the fore-wings partly within the hind-wings, and by a third distinct movement to throw themselves over to one side or the other.

To the above insects having this habit I can now add the following Indian Satyrids:—

Mycalesis indistans, slight list.
Hipparchia parisatis, 20° to 30°.
Aulocera swaha, 45° to 50°.

In the last-named species the same individuals were observed sometimes to go over to the right, sometimes to the left; one was seen to make three efforts, getting further over each time. A specimen of *H. parisatis* was observed *walking about* with a list of 20°.

To these observations I may add that at Yokohama, May 19th, 1904, *Blanaida goschkevitschii*, a Satyrid like a large *P. megæra*, was observed with a list of 40°.

There is no doubt that this sideways attitude makes the insects less conspicuous when resting on a flat surface, but

* See extracts from Col. C. T. Bingham's Diary for December, 1878, quoted in Trans. Ent. Soc., 1902, p. 363.

I have satisfied myself from observations on English Satyrids that the attitude is more often adopted by the butterflies when sitting in sunshine than in shade. Now if the list be away from the sun the shadow would be increased, but if towards the sun it would be diminished, in some cases even to extinction. Numerous observations are required to determine whether the list has any relation to the sun's position. I would however remark that in the case of a butterfly with cryptic colouring on the under-side the shadow is in many cases far more conspicuous than the butterfly itself, as I frequently observed in India. Obviously, therefore, economy of shadow might be a considerable protection. Now, near Simla in October, 1903, in the case of *Pararge shakra*, a butterfly closely resembling *P. megæra*, I noted three individuals in succession settled with their backs to the sun so as to reduce the shadow to a mere line. This was unfortunately just as I was leaving the locality where the species occurred, but I did not observe any instances to the contrary. I should add that in *P. shakra* I looked for, but did not find any list.*

Scents in Butterflies.

Owing to the imperfections of the human nose these are very difficult to detect and to describe, nevertheless certain definite results were obtained.

* Since the reading of the paper Prof. Poulton has called my attention to the following interesting observation by Mr. E. E. Green. "*M. ismene* is an adept at concealing itself. It usually pitches amongst fallen leaves where its form and coloration are sufficient concealment. But even on bare ground the insect is often extremely difficult to localize, though the approximate spot may have been carefully noted. I have watched the fly, immediately after pitching, alter its position so that its axis is directed towards the sun, thus casting no shadow."—"Notes on some Ceylon Butterflies, *Spolia zeylanica*," vol. ii, pt. vi, Aug. 1904, p. 76.

For the following reference I am also indebted to Prof. Poulton :— Prof. G. H. Parker has clearly established that in the United States when *Vanessa antiopa*, L., after a flight settles in full sunshine with wings expanded, it speedily so adjusts its position as to place the axis of the body as near as may be parallel to the sun's rays, with its head turned away from the sun. Some of the genus *Grapta* have the same habit. He thinks they do this to display their colouring to the best advantage. The bearing of his interesting observations on the cryptic attitude of Satyrids is that they prove decisively that a butterfly can acquire the habit of definitely orienting itself. If one can do this for one purpose, another species may do it for a different purpose, *e. g.* concealment. Mr. Parker gives a Bibliography of the subject.—"Mark Anniversary Volume," Cambridge University, Mass., U.S.A., Article xxiii, p. 453–469, 1903.

(1) The *rapæ* scent. Dr. Dixey and I have observed a slight scent in *Ganoris rapæ* well compared by Mr. Selwyn Image to that of sweet-briar, though the comparison is not exact. Curiously enough I have been able to prove to my own complete satisfaction the existence of the same scent, or one scarcely distinguishable therefrom, in several Pierines, viz. *Delias eucharis, Ganoris canidia, Huphina nerissa, Catophaga paulina,* and *Belenois mesentina.*

I think it is confined to the male sex, but cannot speak very positively.

(2) The *brassicæ* scent. This is fainter than the preceding; I compare it to violet-powder. It is confined to the male. This scent I did not find in any Indian butterfly.

(3) The *napi* scent. Far the strongest, and quite unmistakable. It is by common consent compared to lemon-verbena, but it is not identical therewith. This I did not meet with in India, but it was unmistakable in the male of the Japanese *Ganoris melete,* Mén. [My specimens were of what Leech calls the Japanese spring form = *G. aglaope,* Motchulsky, = *G. megamera,* Butl.] It proved equally distinct in the male of *G. oleracea,* Harr., a North American form of *napi.*

That three species of one genus have as many distinct scents, but that one of these extends to members of several widely-separated genera is very remarkable, and to me at least totally unexpected. I cannot help thinking that when these scents have been more studied and are better understood they may prove of great value in the solution of phylogenetic questions.

(4) Several Danaids of different genera have a strong and distinct odour of a disagreeable character, very suggestive of acetylene. That it is possessed by the males I am certain, but cannot say whether it is confined to that sex. The species are *Crastia core, C. asela, C. amymone* (at Macao), *Isamia midamus* (at Hong Kong), *Parantica ceylonica,* and *Chittira fumata.* A single specimen of *Pademma kollari* had a somewhat similar odour. In several cases (in at least three of the above), the scent was so strong as to be distinctly perceptible when the butterfly was fluttering in the net (as it is indeed in the case of *Ganoris napi*).

(5) *Limnas chrysippus* has a faint unpleasant odour like cockroaches, or musk-rats. I suspected it to come from

the pouches on the hind-wings of the male, but more observations are needed.

In the case of *Limnas genutia*, *Tirumala limniace*, *Pararge shakra*, and *Colias nilgiriensis* the existence of scents was suspected, but the results were ambiguous.

(6) The observations of Wood Mason were confirmed in *Catopsilia pyranthe* and *C. pomona*. The tufts on the wings of the males gave out on stroking a scent that may be compared to jasmine, though I think it more like *Polianthes tuberosa*.

Seasonal Forms.

With a view to seeing what light, if any, my fragmentary observations might throw upon this puzzling subject, I have adopted the following method:

In the Register, or Index, of my captures I noted to every Pierine Dr. Dixey's estimate of its seasonal character, and then made my own (far less weighty) estimates of the seasonal characters of the genera *Precis*, *Melanitis*, *Mycalesis*, and *Yphthima*, and then analyzed the results for localities, or groups of localities. The seasonal characteristics were classed under the following five heads:—

(1) Wet-season form, including "wet," "very wet," and "extreme wet."
(2) Somewhat wet form, including "intermediate inclining to wet."
(3) Intermediate form.
(4) Somewhat dry form, including "intermediate inclining to dry."
(5) Dry, including "very dry" and "extreme dry."

Without prejudice, and for the purpose of this grouping only, I took *Catopsilia gnoma* to represent the dry-season form of *C. pyranthe*, and in like manner *Catopsilia catilla* and *pomona* to be dry-season forms corresponding to a wet-season form *C. crocale*.

It must be borne in mind that such a classification is necessarily very vague, for while the extreme forms are easy to place it is most difficult to assess the numerous intermediate specimens.

	Wet Season.	Somewhat Wet.	Intermediate.	Somewhat Dry.	Dry Season.	
Precis orithyia . . .	2	2	...	...	4	
,, *œnone* . . .	...	...	...	...	6	
,, *lemonias* . . .	1	1	...	...	3	
,, *iphita* . . .	...	...	...	...	1	
Catopsilia pyranthe . .	1	...	...	...	1	Simla and Kalka,
Ixias marianne . . .	...	...	1	...	...	Oct. 10–20, 1903.
Terias hecabe . . .	7	...	1	...	...	Slight showers.
,, *læta* . . .	...	2	2	1	...	
Huphina nerissa . .	3	3	...	...	...	
TOTAL . .	14	8	4	1	15	
Precis orithyia . . .	...	...	...	...	3	
,, *œnone* . . .	...	...	...	...	2	
,, *almana* . . .	...	...	...	...	4	Peshawar and
Yphthima balanica . .	1	...	...	...	...	Malakand, Oct.
Terias hecabe . . .	1	3	2	2	1	22–29, 1903.
Teracolus etrida . .	...	...	...	1	...	No rain.
TOTAL . .	2	3	2	3	10	
Precis orithyia . . .	...	...	...	...	1	
,, *almana* . . .	...	...	...	1	2	
,, *lemonias* . . .	...	...	...	...	4	
Catopsilia pyranthe . .	7	...	...	...	...	
,, *pomona* . .	...	1	...	...	...	
Ixias marianne . . .	...	...	1	1	3	
,, *pyrene* . . .	1	2	1	...	...	Lahore, Amritzar
Terias hecabe . . .	5	...	...	...	...	and Delhi,
Teracolus etrida . .	...	...	2	2	2	Oct. 31–Nov. 12,
,, *protractus* . .	2	...	...	...	...	1903.
,, *puellaris* . .	1	...	1	1	3	No rain.
,, *calais* . .	2	2	...	...	...	
Huphina nerissa . .	...	...	...	...	2	
Appias libythea . .	...	...	...	...	1	
TOTAL . .	18	5	5	5	18	

	Wet Season.	Somewhat Wet.	Intermediate.	Somewhat Dry.	Dry Season.	
Precis orithyia . . .	...	...	...	2	2	Naini Tal, Lucknow and Benares, Nov. 16–Dec. 2, 1903. No rain.
,, *œnone* . . .	...	...	...	...	2	
,, *almana* . . .	...	1	...	1	...	
,, *lemonias* . . .	...	1	...	...	2	
,, *iphita* . . .	...	...	...	...	3	
Yphthima philomela . .	...	...	...	...	1	
Mycalesis perseus . .	...	1	...	...	1	
Catopsilia pyranthe . .	1	...	1	...	2	
,, *pomona* . .	...	...	1	1	...	
Ixias marianne . . .	...	...	...	...	1	
,, *pyrene* . . .	...	...	...	...	1	
Terias hecabe . . .	1	...	...	...	1	
Huphina nerissa . .	1	...	...	...	...	
TOTAL . .	3	3	2	4	16	
Precis almana . . .	...	1	...	1	1	Calcutta, Dec. 4–12, 1903. No rain.
,, *lemonias* . . .	...	...	...	...	1	
,, *atlites* . . .	1	1	...	1	1	
Melanitis ismene . .	...	...	...	...	4	
Mycalesis indistans . .	...	...	...	...	2	
Catopsilia pyranthe . .	2	...	...	1	1	
,, *pomona* . .	...	1	...	4	...	
Ixias pyrene . . .	...	...	...	1	...	
Terias hecabe . . .	1	...	2	...	2	
Huphina nerissa . .	1	...	...	...	...	
TOTAL . .	5	3	2	8	12	

	Wet Season.	Somewhat Wet.	Intermediate.	Somewhat Dry.	Dry Season.	
Precis lemonias	...	...	...	...	1	
Melanitis ismene	...	...	...	...	1	
Mycalesis indistans	...	...	...	...	8	
Catopsilia pyranthe	...	...	...	1	...	
Ixias pyrene	...	...	1	5	1	
Terias hecabe	...	...	...	1	6	Darjiling, Dec.
,, *lata*	...	...	...	2	...	13–22, 1903.
Huphina nerissa	1	...	...	...	4	No rain.
,, *nadina*	...	1	...	...	2	
Tachyris hippo	...	...	...	...	1	
Prioneris thestylis	...	...	...	...	1	
Hiposcritia lalage	...	...	2	1	...	
TOTAL	1	1	3	10	25	
Precis orithyia	...	...	...	..	3	
,, *œnone*	...	...	...	...	1	
,, *almana*	...	...	...	...	2	
,, *lemonias*	...	...	...	...	1	Bankipur, Jhansi,
Yphthima inica	...	...	...	2	...	Agra, Jaipur,
Catopsilia pyranthe	1	...	...	1	2	Ajmir and Mt.
Ixias marianne	...	...	...	2	5	Abu, Dec. 24,
Terias hecabe	2	1	...	1	2	1903–Feb. 8, 1904.
,, *lata*	...	...	3	6	10	Slight rain Jan.
Teracolus etrida	...	1	5	2	3	14–23.
,, *puellaris*	...	...	...	..	1	
Huphina nerissa	...	...	...	...	7	
TOTAL	3	2	8	14	37	

	Wet Season.	Somewhat Wet.	Intermediate.	Somewhat Dry.	Dry Season.	
Precis œnone	...	...	...	1	...	Bijapur, Anantapur and Bangalur, Feb. 16–23, 1904. No rain.
,, *almana*	...	...	...	...	2	
Melanitis ismene	...	...	1	...	...	
Hypanis ilithyia	...	...	...	4	...	
Catopsilia pyranthe	1	...	...	...	3	
,, *pomona*	...	...	...	1	...	
Ixias marianne	...	...	...	2	...	
Terias hecabe	...	...	...	1	...	
,, *læta*	...	...	1	...	...	
Teracolus etrida	...	...	2	2	5	
,, *dulcis*	...	...	...	...	1	
,, *amatus*	2	...	...	...	...	
,, *eucharis*	...	...	...	...	1	
TOTAL	3	...	4	11	12	
Precis orithyia	...	...	...	1	...	Nilgiris, Trichinápali, Tanjur, Madura, Feb. 24–March 7, 1904. Very slight rain in Nilgiris.
,, *œnone*	...	...	...	...	1	
,, *almana*	...	...	...	1	...	
,, *lemonias*	...	...	...	1	1	
Melanitis ismene	...	...	...	...	3	
Mycalesis perseus	...	...	...	...	3	
Yphthima hübneri	...	...	...	...	1	
Hypanis ilithyia	1	1	...	...	...	
Catopsilia pyranthe	...	...	2	2	...	
,, *pomona*	...	...	...	1	...	
Ixias marianne	...	...	1	...	1	
,, *pyrene*	...	2	...	3	...	
Terias hecabe	...	...	2	1	2	
Teracolus etrida	1	...	...	...	...	
,, *eucharis*	...	...	...	...	1	
,, *danäe*	3	5	2	1	...	
Huphina nerissa	...	1	3	1	3	
Catophaga paulina	...	1	...	1	4	
TOTAL	5	10	10	13	20	

	Wet Season.	Somewhat Wet.	Intermediate.	Somewhat Dry.	Dry Season.	
Precis almana . . .	4	...	...	...	1	
,, *atlites* . . .	1	2	...	2	2	
Mycalesis mandata . .	1	...	...	...	...	
Catopsilia pyranthe . .	2	...	...	...	...	
,, *pomona* . .	...	...	2	2	1	Ceylon, March
Ixias pyrene . . .	...	...	...	1	...	10–26, 1904.
Terias hecabe . . .	4	2	1	...	1	Several showers.
,, *læta* . . .	...	...	...	...	1	
Huphina nerissa . .	1	...	1	...	1	
Catophaga paulina . .	...	...	2	...	2	
TOTAL . .	13	4	6	5	9	

There was a storm at Simla on October 10th, and a few trifling showers during our expedition to Bághi, but we saw no sign of rain after that, and indeed scarcely a cloud, save at Kurseong, until January 14th, when there was a thunderstorm at Jhánsi. There were then several very slight falls of rain terminating with a long but not heavy rain on January 23rd. There was a very slight fall at Konúr on the night February 29th—March 1st. Then no further rain till Kandy, March 10th. There were several showers in Ceylon.

At Simla the effects of the monsoon were not quite past, and wet-season forms were slightly more numerous than dry; the same applies to Ceylon. At all the other places, as might have been expected, dry-season forms predominated. Calcutta occupies an intermediate position.

It must however be admitted that to prove a species to be dimorphic is not necessarily to prove that the forms are associated with seasons. In the genus *Precis*, so far as my very few observations (limited to the dry season) are worth anything, the two forms ocellated and non-ocellated seem

to be closely associated with wetness and dryness respectively. *Catopsilia pyranthe*, as Dr. Dixey has shown, occupies a far less clear position, and I may add that *Terias hecabe* did not appear to me to follow any rule. The two forms were taken together in most places.

Many dwarfed specimens of the genus *Precis* were met with as the season advanced; with the exception of one *P. almana*, var. *asterie*, they were all of the dry type, most of them markedly so. The smallest *Terias hecabe* was of the dry form, so was a dwarf *Teracolus dulcis*; four dwarfed *T. etrida* were half dry, half intermediate. A dwarf *Belenois mesentina* was dry, but a dwarf *Catopsilia pyranthe* and a dwarf *Huphina nerissa* were intermediate, while a dwarf *Teracolus calais* was actually of the wet-season form.

In conclusion I have to thank the President for much valuable assistance in many ways; I am greatly indebted to Mr. Hamilton H. Druce for most kindly naming all my Lycænids and Hesperids, to Sir George Hampson for much help in naming my moths, to Mr. W. F. Kirby for kindly naming my *Orthoptera* and *Neuroptera*, to Col. C. T. Bingham, Mr. G. E. Austen, and Mr. Claude Morley; to the Rev. F. D. Morice for naming my *Hymenoptera*; to Commander J. J. Walker, R.N., whose practical experience in many lands was of much assistance, and to Mr. W. Holland of the Hope Department for constant help, while to Dr. F. A. Dixey I am indebted not only for the names of all my Pierines and much information about them, but for continual encouragement and inspiration.

VII. *The genus* Criocephalus. By D. Sharp, M.A., F.R.S. *With Notes on the habits of* Asemum striatum *and* Criocephalus ferus. By F. Gilbert Smith.*

Plate IX.

In the Munich Catalogue of Coleoptera (vol. ix, 1872, p. 2789) *Criocephalus* is allotted ten species. Another species has since been added by Herr Edmond Reitter, *C. syriacus*, Wien. Ent. Zeit., 1895, p. 86. *C. coriaceus*, Motsch., must be rejected as the description is totally worthless (cf. p. 158), and no type is known. *C. mexicanus*, Thoms., is treated as a synonym of *C. obsoletus*.

Great confusion has always existed as to the species, and there are numerous errors in the Munich Catalogue. A revision of the genus will therefore be useful as a step towards the attainment of further knowledge.

I owe my thanks to Mr. Gahan for assisting me in the examination of the specimens in the British Museum, and to M. Réné Oberthür, Herr Edmond Reitter, M. Louis Bedel, Mr. G. C. Champion, and Mr. George Lewis for the communication of specimens.

Distribution.

The genus *Criocephalus* is distributed over the Northern hemisphere, occurring in about equal numbers in the Old and New Worlds; it does not pass the equator, and scarcely touches the tropics, except in the highlands of their northern parts. This distribution is probably chiefly determined by the distribution of coniferous trees, to which it is believed the species of *Criocephalus* are confined, their food being found in the wood of these trees. *C. rusticus* has a natural distribution probably as wide as that of any other Coleopterous insect, it is found from Norway to

* Although Mr. Smith has not had any part in actually drawing up the systematic part of this paper, I have received very important assistance from him in this matter. He first noticed the peculiarity of the deficient spur in the group. The notes on the larvæ have been made by us conjointly. I, of course, have had no part in Mr. Smith's account of his observations in the field.—D. S.

Algeria, and in the other direction to Japan, and even in Yunnan. It is probably occasionally carried about with timber, but this cannot have much affected its wide distribution. There is no reason for supposing that any of the other species are increased in the area of their distribution by commercial means, as timber is not imported into most of the countries in which the species live.

Taxonomy.

Criocephalus has been placed in the group *Aseminæ* of the great subfamily *Cerambycides*, a group of only a few genera, but as to the composition of which systematists have very widely differed. Lacordaire (Gen. Col., viii, p. 205, as *Asemides*) assigns to it five genera, *Asemum*, *Nothorhina*, *Cyamophthalmus*, *Tetropium*, *Criocephalus*. Thomson (Syst. Ceramb., p. 463, as *Asemitæ*) places in it nine genera, excluding *Tetropium*, but adding five other European genera. Leconte and Horn (Class. Col. N. Amer., ed. ii, 1883, as *Asemini*) adopt Lacordaire's view, *Cyamophthalmus* being, however, unknown to them; and the same remark applies to Schiödte (Danmark's Ceramb., p. 507, as *Asemini*), who also did not include *Nothorhina*. Duval (Gen. Col. Eur. Céramb., p. 125, as *Criocephalites*) associated *Criocephalus*, *Cyamophthalmus*, *Tetropium*, placing *Asemum* and *Nothorhina* in a distinct group (*Asemites*). Ganglbauer and Bedel, who have, each one, published an excellent work on the European Cerambycidæ, have not dealt at all with the question of minor groups. Kraatz has recently added the genus *Megasemum* (Berlin. Ent. Zeitschr., 1879, p. 97) without, however, giving any character that would distinguish the genus from *Criocephalus*.

On examination it appears that none of the genera hitherto associated with *Criocephalus* are closely allied to it, except *Megasemum*. *Criocephalus* possesses the very exceptional character of having only one spur on the front tibia, while the other genera usually associated with it have two.

Criocephalus syriacus, Reitt., is here made a distinct genus, *Cephalocrius*; it and *Megasemum* agree with *Criocephalus* in the unicalcarate tibia and are extremely closely allied to it.

Megasemum was distinguished by Kraatz solely on the strength of shorter antennæ. This however does not hold

good for the male which has longer antennæ.* Even in the female the antennæ are not shorter than they are in the N. American *Criocephalus asperatus*, to which species *Megasemum* has a great resemblance. *Megasemum* differs however in the form of the prosternum, which is concave in profile instead of convex as in certain *Criocephalus*, or flat as in other species. It has moreover the clypeus much more elongate, the antennæ more distant from the mandibles and the eyes not extended to the under-surface of the head.

I describe also a new genus, *Cephalallus*, that is closely allied to both *Megasemum* and *Criocephalus*. The four genera in question form a natural group to be called *Criocephalinæ*, distinguished from the *Aseminæ* by the presence of only one spur on the front tibiæ.

The four genera of *Criocephalinæ* may be distinguished as follows—

(1) *Criocephalus*. Terminal joint of palpi only moderately broad at tip; prosternum protuberant in front, or flat; clypeus short.

(2) *Cephalocrius*. Terminal joint of palpi very broad at the apex; prosternum nearly flat; clypeus very short.

(3) *Megasemum*. Terminal joint of palpi only moderately broad; prosternum slightly descending; eyes not extended on under-surface of the head.

(4) *Cephalallus*, n. g. Terminal joint of palpi not very broad at tip; prosternum descending; eyes extending to under-surface of the head.

The *Criocephalinæ* should come at the beginning of the subfamily *Cerambycides*, as being one of the most primitive forms of Longicorn Coleoptera. The only other genus of Longicorns that I have found to agree with *Criocephalinæ* as to the unicalcarate tibiæ is the genus *Philus*, which forms an annectant link between *Cerambycides* and *Prionides*. This character is not to be looked on as primitive. The primitiveness of *Criocephalus* depends not on such points as this, but on the fact that it differs but

* The male of *Megasemum* has not yet been described. It is similar to the female but has the antennæ longer and much more hairy. I have seen only one specimen of this sex, it is in the British Museum Collection. For my knowledge of the female I am indebted to Mr. George Lewis, who met with the species in Japan.

little from Coleoptera of other families; that it lacks all the specializations that are so remarkable in other divisions of Longicorns, while but little changes would suffice to make it a member of other divisions, either of *Cerambycides* or of *Prionides*.

CEPHALALLUS, n. g.

Caput brevissimum.

Palpi perbreves, articulo ultimo modice dilatato.

Oculi magni, subtus conspicui.

Prosternum descendens, parum elongatum.

I have only a single example, of the female sex, and in a very mutilated state, before me; but it represents a species of so much interest that I do not hesitate to name it and call attention to it.

A slight modification of the prosternum of this insect would transform it into a *Criocephalus*, while an elongation of the head would apparently make it a *Megasemum*.

The labrum is small and has a pencil of hairs near the front as in *Criocephalus ferus*. Mandibles extremely short, each with a single, strong tooth in the middle. Palpi very short, the terminal joint only slightly, but still distinctly, dilated at the tip. Ligula extending on each side as far as the middle of first joint of labial palpus. Eyes convex, extending on to the under-surface of the head, but widely separated there as in *Criocephalus rusticus*.

Prosternum margined in front; behind the margin extending obliquely downwards; only very slightly separating the front coxæ. Metasternum elongate, terminal segment of the female less elongate than in *Criocephalus*. Hind femora hairy behind, but not densely so.

If the genus be not maintained as distinct it will be necessary to unite *Megasemum* and it with *Criocephalus*.

CEPHALALLUS OBERTHÜRI, sp. n.

♀. Elongatus, angustus, convexus, piceus, elytris ferrugineis; prothorace angusto, convexo, asperato, sculpturato, peropaco, medio late leviter impresso; elytris dense fortiter punctatis, subtiliter, sex-costatis. Long. 22 mm.

Hab. TSEKOU in North Yunnan. (Coll. R. Oberthür.)

The general form is that of a narrow *Criocephalus*, but from all the forms of that genus it is distinguished by the very dense punctuation of the elytra, which renders them

finely rugose. The eyes bear a few fine but moderately long setæ between the facets. The clypeal suture is very deep, and forms an acute angle in the middle. The thorax is a good deal narrower than the elytra, and only slightly broader than the head and eyes; it is scarcely transverse, but is convex transversely, it bears numerous sharp, elevated granules, between which it is minutely rugose, and has some fine hairs; there is a vague, broad depression on the disc, and behind this a feeble prominence in the middle just in front of the scutellum. The elevated lines on each elytron are not very distinct, the two on the middle do not reach the apex, and the lateral one cannot be seen either at the base or apex, the sutural angle is minutely spinose.

The legs and antennæ are very mutilated; all that remains of the former are some portions of femora, and one front tibia. Six joints remain of one antenna: these are rather slender, and bear numerous erect hairs; the first joint is rather more than twice as long as the second; the third is not quite three times as long as the second, the fourth is about as long as the first, the fifth is shorter than the fourth, and the sixth shorter than the fifth and but little longer than the first.

Cephalocrius, n. g.

Antennæ fere corporis longitudine, longius hirtellæ.

Palpi articulo ultimo ad apicem latissimo.

Type *Criocephalus syriacus*, Reitter.

Closely allied to *Criocephalus*, the *C. syriacus* of Reitter is well distinguished by the above characters. I have seen only one example and am not able to describe the parts of the mouth more fully. Herr Reitter informs me that in the female the antennæ are less hairy than they are in the male. The really important character of the genus is the form of the palpi.

Cephalocrius syriacus, Reitter.

Criocephalus syriacus, Reitter, Wien. Ent. Zeit., 1895, p. 86.

♂. Angustus, subdepressus, ferrugineus, elytris bicostatis et crebre punctatis, antennis corporis longitudine subtus hirsutis; tarsis posterioribus articulo tertio profunde fisso, articulo basali elongato. Long. vix 15, lat. 3¾ mm.

This is very distinct by the strongly dilated terminal joint of the palpi which is broadly securiform, both on the maxilla and labium. The hind tarsi are long and slender, with remarkably long basal joint. The eyes are rather more prominent and have a greater extension on the under-surface of the head than they have in *C. rusticus*. The sculpture of the gular area is transversely rugose, the impressed punctures not numerous. This insect was kindly sent home by Herr Reitter with the locality "Syria." In his description he mentions, Haifa, Akbès. There is also a male example from Akbès in the Oberthür Collection.

N.B.—The British Museum Collection contains a specimen of this genus from the collection of Dejean. It is in very bad condition, and I do not know whether it is *C. syriacus* or another species. In Dejean's collection it was labelled "*rusticus*, Gall. mer." The locality from which this specimen really came is, I consider, extremely doubtful.

Criocephalus, Mulsant.

Criocephalus (Dej.), Muls. Longicornes, ed. i, p. 63.

I have already mentioned the characters that distinguish this genus from the allied forms (p. 147).

The species present a great uniformity of appearance and as they are fairly numerous it is not easy to distinguish them. Particular attention should be given to the form of the thorax, the length of the small setæ between the facets of the eyes, and the form of the third joint of the tarsus.

The genus has been subdivided by the eyes being "hairy" or "bare." But this is incorrect; all the species have some setæ between the ocular facets, and it is only a question of longer or shorter. The same remark applies to the lobing of the third joint of the tarsus, which differs somewhat from species to species. The labrum apparently offers a better character, but unfortunately it is not easy to see without opening the mandibles and this it is somewhat difficult to do, as they are closed by very powerful muscles, which cannot be ruptured after the insects are dead and dried.

Group A.

Labrum without pencil of hairs in fovea on the middle of its area. Eyes with long hairs between the facets.

Criocephalus deceptor, sp. n.

Depressus, fusco-niger, breviter griseo-pubescens, opacus ; thorace fortiter transverso ; elytris bicostatis fortiter punctatis. Long. 20 mm.

This species is an extremely distinct one, though it looks at first sight very like a moderately-sized individual of *C. rusticus*. It is however more depressed than that species, and this character removes it from all the other described species.* From *C. rusticus*, *C. deceptor* differs strongly by the tarsal structure, the third joint being only slightly lobed. The unique specimen is much damaged; the prosternum is not in the least degree protuberant or convex, and the under-surface is remarkably flat. The labrum is of the type of that of *C. rusticus*.

Hab. Western Tibet, one specimen in the collection of the British Museum.

Criocephalus rusticus, Dej.

Brunneo-ferrugineus, vel fusco-niger, subplanatus, elytris sat discrete bicostatis, inter costas perspicue punctatis ; prothorace transverso, ad latera fere regulariter rotundato, posterius plus minus angustato. Long. 14–30 mm.

The male has the basal portion of the antennæ, and the legs markedly thicker than the female.

The synonymy of this species, as distinguished from *C. ferus*, is very doubtful. Some of that given in the Munich Catalogue is taken from writers who did not distinguish the two forms. The *C. rusticus* of Dejean's Catalogue and collection is however certainly this species, as is also Mulsant's *C. rusticus*, and var. B., l. c., p. 64. Also *C. rusticus*, Woll. Cat. Col. Madeira (1857), p. 124 (nec Col. Canar., for which see *C. pinetorum*).

The species is readily distinguished by the strongly transverse thorax, which is only one-fifth of the length of the elytra, and by the gular area being very indefinitely limited, rugose in front and feebly punctate behind, and with only a few suberect long hairs, forming a strong contrast to what exists in *C. ferus*. In finely-developed

* There is an undescribed (?) species in the collection of the British Museum, coming from the Amanus mountains of Asia Minor, which is also very depressed; but in other respects this insect is very different from *C. deceptor*.

specimens the sculpture of the gular area is more largely developed, there being both more rugæ and more punctures, but the sculpture always retains the same character. The setæ between the facets of the eyes are so long that they can be easily detected; the third joint of the tarsus is divided nearly to the base, and the lobes formed by the division are large and symmetrical. The scutellum is always a little impressed along the middle. The metathoracic epimera are comparatively narrow.

The species is very variable in size, form and sculpture, but after repeated examinations I fail to find any reliable character to separate even the most extreme forms. The length varies from 14–30 mm. and the width from 4–7½ mm. The female is generally larger than the male and is somewhat darker in colour, but is never quite black. There are sometimes three depressions on the thorax, and these in a few specimens are deep and well-marked. The sculpture of the upper-surface also varies: it is sometimes coarser and less dense, and the insect appears slightly shining. The elytra usually have the tip-sutural angle sharp, or rectangular, but this also is variable. The rugæ on the gular area vary a good deal, but the sculpture there never has the character of definite depressed punctures, and it bears only an irregular, somewhat scanty pubescence, never the regular dense pilosity of the *C. ferus* group of species. The setosity on the labrum also varies.

I have examined the male organs in some of the most remarkable of the varieties and find they agree. The two closely appressed laminæ that form the tip of the introminent organ are not of equal length, but the lower one is the longer and is very sharp. In this respect *C. rusticus* differs from *C. ferus*.

I think it quite possible that careful study of a series of good examples of both sexes may show that there is really more than one species mixed under *C. rusticus*. I should recommend a thorough scrutiny of the labrum as likely to give good results, but this is unfortunately attended with great practical difficulties.

The species inhabits apparently all the temperate zone of the Old World in the Northern hemisphere, wherever there are suitable timbers; what species of conifer it may prefer I do not know; but doubtless the Scotch fir (*Pinus sylvestris*) is one of them. I have specimens before me from Norway (Champion); Hanover; Vienna; S. France;

Spain, Bronchales, Tragacete, La Granja (Champion); Corsica, Vizzavona (Champion); Akbès (Coll. Oberthür); Amurland; Japan (Lewis); Tsekou in North Yunnan (Coll. Oberthür); and I have seen specimens from Madeira and other localities.

The species has recently been discovered by Colonel Yerbury at Nethy Bridge, near our wildest Highlands, where the Scotch fir is still extant in its natural state. The specimen he found was on a sprig of heather near a large stump of the Scotch fir. It is a fine female and is now in the collection at the British Museum.

This specimen is I think undoubtedly a native of Britain, and it is of importance as showing that the discovery for the first time of a *Criocephalus* in a locality is not sufficient evidence of its being an introduction. Mr. Gilbert Smith's extremely interesting notes on the natural history of *C. ferus* and *Asemum striatum* should also be considered in this connection. There can however be little doubt that this species is liable to be carried about; though probably this only occurs as an exception, even when large blocks of timber are transmitted. A specimen has been found in a coal-mine in Wales, where it was pretty certainly carried in the wooden props; and if foreign fir-wood be used for railway sleepers it may thus be transmitted. The case recorded of its introduction by means of timber for masts must also be noticed.

C. rusticus was not known to Wollaston when he wrote the "Insecta Maderensia" (published in 1854), but it afterwards became common in the plantations of introduced fir-trees, and in 1857 was recorded by him in the category of "undoubtedly introduced" species. [The "*C. rusticus*" of the Canary Islands is *C. pinetorum*.] It appears to have spread with rapidity in the Madeiran group, as in 1865 Wollaston recorded it from the extreme summit of the small island called Dezerta Grande. But this must be received with some caution, as it is far from impossible that *C. pinetorum* occurs in Madeira as well as in the Canaries.

Criocephalus coreanus, sp. n.

♀. Fusco-niger, haud nitidus, antennis pedibusque piceis; prothorace parum transverso, densissime rugoso-punctato, ad latera numerose muricato; elytris costis duabus parum elevatis, punctisque impressis per-numerosis. Long. 22 mm.

In this species the thorax is about one-fourth the length of the elytra, whereas in *C. rusticus* it is about one-fifth. On measuring two specimens of about equal size I find them to be, *C. coreanus*: thorax $3\frac{5}{8}$, elytra $15\frac{1}{2}$ mm. long. *C. rusticus*: thorax $2\frac{7}{8}$, elytra 15 mm., and these proportions persist (with some variation) in the individuals of different sizes of *C. rusticus*. The head and thorax of *C. coreanus* are also considerably narrower, and the antennæ more slender. The length of the thorax is $4\frac{3}{8}$ mm. The sculpture of this part is denser and finer than it is in *C. rusticus*. The scutellum is narrower than in *C. rusticus*, almost flat, with a slender polished line along the middle.

Although I have only one mutilated female of this form I have little doubt that it represents a species closely allied to *C. rusticus* but distinct. The structural characters appear to agree with those of *C. rusticus*. It should be noted that the Japanese form of *C. rusticus* is very different from *C. coreanus*.

Criocephalus obsoletus, Randall.

Criocephalus obsoletus, Leconte, J. Ac. Philad. ser. 2, II, p. 196 [=*obscurus*, id. p. 36].

Criocephalus mexicanus, Thomson, Classif. Longic. 1860, p. 260; Bates, Biol. Cent. Amer. Col., V, p. 15.

This species is extremely near *C. rusticus*, but will probably prove to be distinct. I have only one specimen at my disposal. The sculpture of the upper-surface is rather coarser. The thorax has a slight angulation at each side; the second joint of the antenna is a little longer, and the scutellum is broadly impressed.

Hab. N. America: widely distributed and apparently not uncommon in Mexico, "in pine forests at the higher elevations."

I have followed Mr. Gahan, in his arrangement of the British Museum *Criocephalus*, in considering *C. mexicanus* of Thomson and Bates to be a synonym of *C. obsoletus*.

For remarks on the North American species generally see under *C. nubilus*.

Group 2.

Labrum with a pencil of hairs placed in a fovea in the middle near the front.

N.B.—I have not been able to examine the labrum in *C. exoticus* and *C. tibetanus*, and one or both may therefore prove not to belong to this division. Neither the hairs on the eyes nor the lobing of the tarsi can be used as sectional characters as there are intermediate conditions of both of them. But in this section the ocular setæ are usually short, and the basal lobes short.

Criocephalus pinetorum, Woll.

♂. *Criocephalus pinctorum*, Woll., Journ. Entom. II, p. 103 (1863); and Cat. Col. Canar., p. 388 (1864).
♀. *Criocephalus rusticus*, id. Col. Atlant., p. 345 (1865).

Wollaston first fell into the double error of considering the sexes of *C. pinctorum* to be different species and of determining the female to be *C. rusticus*. This was not recognized by him in revising the work in 1865, and being then baffled to distinguish the *C. pinctorum* he sank the species as being merely *C. rusticus*, from which however it is totally distinct. This does not complete the sum of Wollaston's confusion; for he considered the Madeiran *C. rusticus* to be the same, though he noticed the different habitat in the two islands. The insect found about Funchal in Madeira in connection with the introduced, planted, conifers is really the *C. rusticus* of authors, while the *C. rusticus* of Wollaston Coll. Atlant. (nec auctt.), found in the native pinals of the Canary Islands, is the female of *C. pinctorum*, Woll., and is a quite distinct, precinctive species. As Wollaston found the two together in the Canaries it appears remarkable that he should not have considered them to be the sexes of one and the same species. Probably he suspected them to be so, but not having detected the characters that distinguish the female from *C. rusticus* and *C. ferus* (which at that time were generally confounded in collections), he finally came to the erroneous conclusion that all were one species. Hence this good species has since been lost sight of. Bedel however suspected some error; and in placing the name as a synonym of *C. rusticus* added a note of interrogation.

This species has the eyes bare (*i. e.* with extremely short setæ between the facets) and the fourth joint of the tarsi intermediate between that of *C. rusticus* and *C. ferus*. The sexes are very different, and hence Wollaston supposed

the female to be *C. rusticus*. The female differs from the male by its large size, black colour, and the usual differences in the length of the antennæ and the structure of the apex of the abdomen.

"Abounds in the Ancient Pinals of intermediate and lofty elevations" (Woll. 1865), but nevertheless is excessively rare in collections. Recorded from the islands of Palma, Teneriffe, and Hierro.

The male is small (sometimes only 10 or 11 mm. long) and of a brown colour, the gular area is very definitely limited behind, almost semicircular, and is closely and coarsely punctured, the bush of erect pubescence moderately dense.

The female has not been described. I have seen only two specimens of it, one in my own collection and one in Wollaston's Canarian collection, where it stands as *C. rusticus*. It is more flat than the corresponding sex of *C. ferus*, and has a more transverse thorax. The punctuation of the gular area is remarkably definite, and extends over a large space; the prosternum is but little convex in front, and the metathoracic episternum is much narrower. In these latter respects, as well as in the more deeply divided third tarsal joints, it approaches *C. rusticus*.

Criocephalus ferus, Mulsant.

Transversim convexus; mas fusco-niger, femina nigricans; opacus, elytris bicostatis, inter costas tantum subtilissime punctatus. Long. 10–30 mm.

The male is usually shorter and paler in colour than the female and the prosternum is much less convex. This species is rare in collections, and owing to this and to the want of knowledge as to the sex-differences are due its confusion with *C. rusticus* by entomologists. The two forms are really profoundly different. The structure of the labrum distinguishes the two absolutely, but there are numerous other characters. In the male of *C. ferus* the basal portion of the antennæ is but little thicker than in the female. In the female the front of the prosternum is more convex, and the metathoracic episterna considerably broader than in *C. rusticus*. The under-surface is altogether more closely and finely punctate and pubescent and therefore less shining. The scutellum in *C. ferus* is never in the least depressed along the middle; and the sculpture

and pubescence of the gular area are very different. In *C. rusticus* the tarsi have the third joint divided almost to the base, and the setæ on the eyes are very conspicuous; while in *C. ferus* the eyes appear to be bare, and the tarsal lobes are less perfect.

The species is extraordinarily variable in size, some specimens of the female being quite three times as long as the small males, and are broad in proportion; so that it would take twenty or thirty of the small males to make up the bulk of one of the largest females. There are also some variations in the proportions of certain parts of the body, so that I at first thought there to be more than one species under the name of *C. ferus*. A series from Algeria kindly communicated to me by M. Bedel has convinced me that this is not the case. There is also great variation in size independent of sex, some of the females being six or eight times the bulk of other individuals of the same sex. The distance between the eyes on the under-surface of the head varies somewhat, and correlative with it there is a difference in the sculpture of the gular area. I distinguish the following variety with some doubt, having seen only two examples.

C. FERUS, var. n. HISPANICUS.

Minor, praesertim angustior, elytris fere ecostatis. Long. ♂ 14, ♀ 16 mm.; lat. ♂ ♀ 4 mm.

I have seen only a single pair found at Navalperal in the Guadarrama range by Mr. Champion. They were in company with *Nothorhina muricata* and are damaged by turpentine. There is a slightly larger specimen from the same locality in the Oberthür collection. The sculpture of the gular area appears to be more rugose and less definite than in other forms of *C. ferus*, but the distinction in this respect from certain other Spanish examples is not great. It would take eight such females to attain the mass of a well-developed female of *C. ferus*.

C. ferus has a very wide distribution, but is rarely met with, and then usually only in one or two individuals. Lapland (Coll. Oberthür from Coll. Thorey); Denmark; S. England; France (various localities including Fontainebleau, in August 1898, Coll. Bedel); Portugal; Spain; Corsica; Algeria; Pıræus, Besika Bay; Caucasus (Leder); Akbès (Coll. Oberthür); Madeira.

The synonymy of this species is a rather difficult question. The oldest name that certainly applies to it is that given by Dejean in his collection as a var. of *C. rusticus*, and formally published by Mulsant in 1840. *C. polonicus*, Motsch. (1845), is probably this species. As regards *Callidium triste*, Fabr., Mant. Ins., p. 154, the brief description gives no special reason for supposing it to be a *Criocephalus*, except that he likens it to *C. rusticus*. The *C. lugubre*, Gmelin, is simply an error; he copies Fabricius' description of *C. triste*, and, as he gives no reason for changing the name, he probably merely wrote "*lugubre*" in error for *C. triste*.

The following is therefore the only synonymy for which I can venture to take any responsibility.

Criocephalus rusticus, var. *ferus*, Dej., Cat. Coll. (not described); Mulsant, Long. France, ed. I, p. 4.
? ? *C. coriaceus*, Motsch, Bull. Mosc., 1845, i, p. 89.
? *C. polonicus*, Motsch., l.c., p. 88.
C. epibata, Schiödte, Kroyer Tidskr. (3), ii, p. 521 (1864).
C. ferus, Kraatz, Berlin. ent. Zeitschr., 1863, p. 107, and op. cit., 1872, p. 319; Bedel, Faune Col. Seine, v, pp. 23 and 69.

Criocephalus nubilus, Lec.

Criocephalus nubilus, Leconte, J. Ac. Philad., ser. 2, II, p. 36.

This species has strong punctuation on the elytra like *C. rusticus*; the tarsi have moderate lobes like *C. pinetorum*. The labrum, I believe, brings the species in the *C. ferus* group. The sculpture of the gular area is coarse and deep, but occupies only a small area. The eyes bear long setæ. The prosternum is slightly convex in front.

Hab. N. America.

N.B.—The North American *Criocephalus* require a thorough revision, for which the material does not exist in this country, so far as I know. Leconte, new species North American Coleoptera, Part II, 1873, gives no less than seven species as North American. He divides the genus into two groups: (1) tarsi feebly lobed, *C. productus*, *C. agrestis* and *C. asperatus*; (2) tarsi deeply divided with long lobes, *C. montanus*, n. sp., *C. obsoletus*, *C. nubilus*, *C. australis*. The matter stands practically as he thus left

it thirty years ago. *C. montanus* is perhaps a variety of *C. nubilus*. *C. obsoletus* and *C. mexicanus* are treated in the British Museum collection by Mr. Gahan as being the same species, and he is probably right. *C. australis* I do not know; it is probably another genus, as suggested by Leconte.

In the Bull. Brooklyn Soc., vol. vii, 1884, pp. 63, 64, there is given a table of the North American *Criocephalus*, but it is not of any importance. It is taken from Leconte; and some synonymy is added that is apparently taken from the Munich Catalogue; there is also a figure of "*C. productus*," which is certainly not representative of that species, but is more like *C. asperatus*.

C. nubilus differs from the first Lecontian group of species by having shorter hairs on the metasternum, and longer setæ on the eyes. It differs from *C. tibetanus* by the less transverse thorax and the much larger lobes of the tarsus.

CRIOCEPHALUS TIBETANUS, sp. n.

♀. Major, fusco-niger opacus, prothorace sat transverso, elytris bicostatis, fortiter punctatis. Long. 24 mm., lat. 6¾ mm.

Although this insect looks like *C. rusticus*, and has sculpture similar thereto, it is allied to *C. ferus*. No setæ are visible on the eyes, there is a bush of erect pubescence on the gular area, and the third tarsal joint is only slightly bilobed. The labrum I have not been able to examine, so that the position of the species is doubtful. The gular area is not definitely limited behind, it is very broad, densely sculptured, rugose in front, rather finely punctured behind.

Hab. TIBET.

The type is in the British Museum, and was found in East Tibet by one of the collectors of the late Mr. J. H. Leech. A very similar insect from Tibet is the *C. decceptor* described on a previous page.

CRIOCEPHALUS EXOTICUS, sp. n.

♂. Angustus, niger, prothorace haud transverso, profunde biimpresso; elytris obsoletissime costatis et punctatis. Long. 17 mm., lat. 5 mm.

Described from a single male in bad preservation in the collection at the British Museum. The eyes have no long

hairs. The gular area is deeply rugosely punctate, and bears a bush of long black hair. The front of the prosternum shows some deep rugae. The second joint of the antennæ is elongate, about as long as the first joint. The third joint of the tarsus is very little emarginate. Structure of labrum not definitely ascertained. The species is no doubt quite distinct; it looks like the North American *C. agrestis* or *productus*, but appears to be nearer to *C. ferus*, notwithstanding the intense black colour of the male.

Hab. North Chin Hills, Burma. Lieut. Watson in 1894.

Criocephalus agrestis, Kirby.

Angustus, sat elongatus niger, elytris fusco-nigris; prothorace bi-impresso ad latera vix angulato; elytris bicostatis, inter costas subtilissime sculpturatis. Long. 18½ mm., lat. 5 mm.

This North American insect in the male sex greatly resembles *C. ferus*; it is rather more slender and shining, and has a smaller thorax, which has a very slight angular prominence at each side of the middle. I can give no information as to the distribution of this species in North America.

Criocephalus productus, Lec.

Gracilis, elongatus, niger, elytris maris dilutioribus; prothorace haud transverso, disco inaequali, tri- vel quadri- impresso, ad latera subangulato; elytris elongatis, costatis, inter costas crebre perspicue punctatis. Long. 20–26 mm., lat. 4⅞, 6½ mm.

Readily distinguished from *C. agrestis* by the more elongate form, the less transverse thorax and the more developed sculpture of the elytra. The sculpture of the gular area consists of fine rugosities, and there is not much beard.

Hab. N. America.

The species is, I believe, not uncommon in N.W. North America. I have specimens from Montana (*Morrison*); Vancouver (*Mathew*); California (*Hepburn*).

Criocephalus asperatus, Lec.

Latior, robustus, niger, elytris interdum dilutioribus; prothorace disco inæquali, ad latera numerose muricato-asperato, lateribus angulatim prominalis; elytris bicostatis, sculptura inter costas obsoleta; antennis articulis ultimis quatuor abbreviatis. Long. 21–27 mm., lat. 7¼ mm.

This very distinct species cannot be mistaken for any other, the structure of the antennæ being very peculiar. The terminal four joints are abruptly shorter than the preceding, the eighth joint being scarcely half as long as the sixth. There is not much difference between the sexes. The male has the legs and antennæ rather thicker and the terminal joints of the latter not quite so abbreviate. The bush of hair on the gular area is very remarkable in this species. And the clypeus is considerably larger than in any other species; in this last character it approaches the genus *Megasemum*.

Apparently common in N.W. North America; it extends at any rate from Montana in the north of the United States to Guaymas in Northern Mexico (*Mathew*).

Larvæ.

We have found larvæ of at least three species of Longicorn Coleoptera in the wood of the Scotch fir-trees in the New Forest, viz. *Rhagium bifasciatum*, *Asemum striatum* and *Criocephalus ferus*. These three larvæ are extremely similar. The characters of the three forms have been described by Schiödte, so that it is only necessary here to give diagnostic characters. Schiödte and the other writers on the subject have given no information as to the habits of the three larvæ, and as these exhibit very striking differences, Mr. Smith's notes on this subject will doubtless be acceptable to a wide circle of entomologists.

The three larvæ, as already stated, are of three different genera, *Asemum*, *Criocephalus* and *Rhagium*. Mr. Smith has never met with all three contemporaneously associated, but *Asemum* is frequently found in the same stumps as *Rhagium*; and in the trees in which *Criocephalus* has been found in this country it is also associated with *Asemum*.

Notwithstanding the extreme resemblance of the three larvæ, they may be readily distinguished by the spines at the anal extremity of the body. In *Rhagium* there is only one spine (Plate IX, fig. 9); in *Asemum* there are two spines placed near one another and divergent (Plate IX, fig. 8); in *Criocephalus* there are two spines placed at a little distance from one another (Plate IX, fig. 7) and parallel, or even at the tips very slightly convergent. In profile the two *Asemum* spines are straight; in *Criocephalus* they are slightly directed upwards.

Asemum larva. The description and figures given by Schiödte (Naturalist. Tidskr. (3) x, Plate xiv, pp. 443) are correct so far as they go, but he has given of the whole larva, and in his figure of the head has omitted all details of sculpture and clothing. We have not been able to find any other drawing of *Asemum* larva, and have therefore given a figure (Plate IX, fig. 6). Beyond the character we have already mentioned, drawn from the spines, there are only very slight marks of distinction from the larva of *Criocephalus*; *Asemum* larva has the surface slightly more shining, the upper-surface of the head is conspicuously shining, its colour is paler, and the whole head is less robust and powerful than it is in *Criocephalus*.

Criocephalus ferus larva (Plate IX, fig. 5). Larva of *Criocephalus* has been described by Schiödte, and some of its parts figured by him, t. c., Plate xiii, figs. 11–19. His species he considered to be *C. rusticus*, and, notwithstanding the confusion that has existed for so many years as to *C. ferus* and *C. rusticus*, there is little doubt that he was correct in his determination. The larva of *C. ferus*, as found in the New Forest, agrees very closely with Schiödte's description of *C. rusticus*. If actual comparison could be made of the two larvæ some distinctions would probably be found. The head of *C. ferus* larva appears to be shorter than Schiödte's figure, the part behind the clypeus especially shorter, and destitute of the peculiar lobe-like marks shown in Schiödte's figure.

The larvæ of *Asemum striatum* (fig. 6) and of *Criocephalus ferus* (fig. 5) resemble one another extremely. *C. ferus* larva is much larger when full-grown; it attains a length of 30 mm. or more, and a width across the thorax of 9 or 10 mm.; the terminal segments are more ample; the mandibles and margin of the head are black; the chitinized patches—darker in colour—are more definite and conspicuous; the under-side of the head is rough and pubescent, and darker in colour than in *Asemum*; the antennæ are shorter in comparison; the two short spines placed at a little distance from one another (Plate IX, fig. 7) at the extremity of the body are, as already pointed out, diagnostic. The spiracles of the *Criocephalus* larva are more elongate (less circular) than they are in *Asemum*. There is a good deal of difference in the way these two larvæ distend their segments for the purpose of

progression in their burrows, and for working at their excavation.

Rhagium bifasciatum. This larva is abundant in the New Forest, and unlike the larvæ of *Criocephalus* and *Asemum* is easily obtained owing to its totally different habits. The *Rhagium* lives only in the soft wood that has commenced to decay.

I will here call attention to a very remarkable variation that has been detected by Mr. Gahan during the progress of this memoir. By the courtesy of the Director of the British Museum (Natural History) I am able to figure it. I have in the preceding pages formed the group *Criocephalinæ* for certain forms that have only one spur on the front tibia (Plate IX, fig. 14), instead of two as is usual in the Cerambycidæ (Plate IX, fig. 13). In the British Museum collection Mr. Gahan has detected a female *Criocephalus rusticus* having two spurs (Plate IX, fig. 15) on the tibia of the left front-leg. Unfortunately the right front-leg is missing in this specimen, but when the individual was first observed it possessed both anterior legs, and Mr. Gahan and myself are pretty certain that both legs possessed the two spurs.

There appears to be nothing else abnormal about this individual. It may be described in brief as a specimen that departs from charact r of its species, genus and tribe; taking on the character of another tribe. The character abnormal in this specimen is normal in Cerambycid Coleoptera generally.

It would be almost useless to discuss the nature of this variation without further information. Some will see in it a case of "reversion." Mr. Punnett has suggested to me that it is probable that other specimens similarly "abnormal" may be found in the locality where this *C. rusticus* comes from, and if so the case might be viewed as one of more continuous heredity.

On the other hand, it must not be forgotten, that two spurs are normal on the other legs of *Criocephalus*; so that it is possible to view the abnormality as a case of homœotic variation (*Bateson*).

Summary of changes and additions made in the preceding paper:—

Criocephalinæ, new group separated from *Asteminæ*.
Cephalallus, n. g., *C. oberthuri*, n. sp., Yunnan.

Megasemum, defined and male of *M. 4-costatum* described.
Cephalocrius, n. g. for *Crio. syriacus*, Reitter.
Criocephalus pinetorum, Woll., established as a valid species.
Female described for first time.
C. deceptor, *coreanus*, *tibetanus*, *exoticus*, n. spp.
C. ferus, var. *hispanicus*, n. var.
C. obsoletus, Rand. = (*mexicanus*, Th.), n. syn.
C. rusticus, description of an aberration.

Explanation of Plate IX.

Fig. 1. Under-side of head of *Criocephalus ferus*.
2. ,, ,, ,, ,, ,, *rusticus*.
3. Labrum of ,, *ferus*.
4. ,, ,, ,, *rusticus*
5. Larva of *Criocephalus ferus* nearly full-grown.
6. ,, ,, *Asemum striatum*, profile.
7. Spines terminating the body of larva of *Criocephalus ferus* seen from above and in profile.
8. Do. do. *Asemum striatum*.
9. Spine terminating body of larva of *Rhagium* seen from above.
10. Portion of larva of *Criocephalus ferus*, showing form and position of spiracles and the vestigial legs.
11. One of the legs more highly magnified.
12. Egg of *Criocephalus ferus*.
13. Portion of front-leg of *Asemum striatum* ♀ showing the two spurs.
14. Portion of front-leg of *Criocephalus rusticus* ♀ showing the single spur.
15. Portion of front-leg of *Criocephalus rusticus* ♀ abnormal specimen from Amanus mountains, showing the existence of two spurs as in *Asemum*.

VIIa. *The Habits of* Asemum striatum *and* Criocephalus ferus.

[Read February 1st, 1905.]

Asemum striatum was, prior to 1902, known in Great Britain almost exclusively as an inhabitant of Scotch fir (*Pinus sylvestris*) forests in Scotland.

Dr. Sharp recorded a specimen from Dumfriesshire in 1879. Messrs Rye and Skinner in recording the capture of a specimen in 1893, in the New Forest, said—"We believe this to be the earliest record of the species from the South of the Border" ("Entom. Mo. Mag." xxx, 1894, p. 277). Nevertheless we have no doubt that it has been abundant in the New Forest for a long period of years, and has only failed to be detected because of its habits.

During May and June in 1902, while staying at Bournemouth, I made several entomological excursions, with the express purpose of obtaining Longicorn beetles in the larval and pupal stages. It is well known to be very difficult to rear these insects, and it may therefore be well to explain my method.

My articles of equipment for this work included a thin-edged teaspoon for picking up larvæ and pupæ; a small tobacco-box fitted up with short lengths of bamboo-cane of different diameters to serve as artificial burrows for the pupæ. The nearer the bamboo sections correspond with the burrows from which pupæ are taken, the greater are the chances of rearing them.

Also a number of cylindrical strong glass bottles with metal screw caps, each one of which is intended for a separate larva. The bottles are filled tightly with two or three pieces of wood and wood refuse taken from the larval burrows; a suitable cavity is made between the pieces of wood and the larva is inserted. Care is necessary in order that the larva is not too tight nor yet too loose. Once the larva is well established in its new burrow there is not much risk of its dying. M. Valery Mayet advocates the keeping of the Longicorn larvæ in galleries bored by a large gimlet in solid wood (Bedel, Fauna Col. Seine V, p. 77). For larvæ in their last year or so, however, the

method I describe is very useful, and with care quite satisfactory. The chief thing to guard against is empty cavities which encourage mildew.

I secured and reared at this time several of the more common species, and at a place near the South Coast I first made acquaintance with *Asemum striatum*.

Emerging from a Scotch fir wood which I had been working for some hours, and feeling tired, I sat down on one of a great number of stumps of fir-trees which had been cut down three or four years previously.

The tops of the stumps rose several inches above the roots. I immediately noticed a number of distinctly oval and clean-cut holes on the table-like surface of the stump and concluded that they were the work of a Longicorn unknown to me.

While examining these holes I noticed a new hole actually beginning to form, and through it a mandible of a beetle appeared. With my knife I enlarged the hole until the boring itself was laid open to view. The beetle however had vanished down its burrow. I therefore brought a small axe into play. I soon found however that the stump was perfectly sound and almost as hard as my axe; added to which, the roots radiating in all directions made it impossible to split off large pieces. However, after about an hour's hard work I came in sight of the beetle, but not of the bottom of its hole, for it seemed to be able to retreat indefinitely. I at last laid down my axe and sticking a pin into the end of a thin twig hooked the beetle out minus two legs. This was my first *Asemum striatum* taken from the bottom of its gallery thirteen or fourteen inches long excavated in solid Scotch fir. This concluded my day's work, but I revisited the spot next day, and after investigation I found that most of the stumps were covered with holes almost all of which were quite recent, and I also discovered that if I approached very cautiously I could see the heads of the beetles at the mouths of their burrows; in many cases they were widening them to the required size of exit. In some stumps I thus observed as many as twenty beetles at once. But to secure them was quite a different matter; for as soon as I touched a stump every beetle disappeared down its hole not to appear again for an hour or so. I spent several days carefully investigating the situation; during which time I was only successful in securing about

half-a-dozen maimed specimens. One stray specimen I found on the ground among bits of bark. I did not see one on the wing although there was brilliant sunshine. During these two or three days I must have seen many hundreds of the insect, all in their holes. The explanation of this is that the insect is purely nocturnal in its habits, taking refuge in its burrows during the daytime when possible. It would appear however that though nocturnal, it likes the sunshine, as most Longicorns do. The odd specimens which subsequent to 1902 have been found at different places have been stray insects most likely near very strong colonies, seeing that from the colony I refer to I only found one straggler. During the last day I spent at this place at this time I devised a very simple but effective method of obtaining specimens, and I took in half-a-day about eighty. It would not, I think, be fair to the insect to make this method generally known. Among this number there were two of the var. *agrestis*, which is a true variety and not an immaturity, as has been supposed.

The normal insect, while undergoing the process of hardening never assumes the brick-red tint of var. *agrestis*, but rapidly changes from various hues of dull brown to pitchy black; some however are not so black as others, while var. *agrestis* having once arrived at the brick-red colour retains that hue. Dr. Sharp has taken a stray specimen of the var. *agrestis* on the wing, which proves its maturity.

The situation I have referred to fulfilled at the time the conditions necessary for a successful colony, which are as follows:—

i. That the wood shall be dead or enfeebled, but not have commenced to decay.
ii. The wood must not have been attacked previously by *Rhagium bifasciatum*, as the two are not friendly, though the existence of *Asemum* facilitates that of *Rhagium*.

Probably the insect exists in the same stump (not including the thin rootlets) during a maximum period of five years. My supposition is based on the following:—

Throughout the three years during which the first brood is maturing, there are no visible punctures on the

flat face of the stump, consequently the rain does not penetrate into the wood in quantities sufficient to hasten decay. Moreover, when the tree was felled a coating of resin was formed on the surface, which prevented the water from sinking in. For three years therefore the wood was perfectly sound and free from superfluous moisture and quite unsuitable for the accommodation of *Asemum's* greatest enemy, viz. *Rhagium bifasciatum*.

During these three years successive broods of larvæ entered upon existence.

When at the end of this period the first brood emerged as perfect insects, the second brood had to live the final year of their lives under far less favourable conditions than the first; for every time it rained during that year, the open burrows of the larvæ that had already developed conducted the water into the centre of the stump, everywhere spreading decay, which had the effect of driving some of the larvæ deeper into the roots while many perished.

This was proved by the fact that when I revisited this spot the following year with my friend, Mr. Willoughby Ellis, although a fortnight later than in the previous year, there were but few recent though many old burrows.

The third brood exists under very unfavourable conditions; for, in the first place, they were tiny one-year larvæ when the rapid disintegration, caused by the open burrows conveying the rain into the stump, commenced. In the second place, these unfortunate larvæ before they were much older found that their burrows were repeatedly crossed with the ever widening ones of their great rival *Rhagium*, which species, owing to the decay caused by repeated rains, has now completely gained the mastery over the stump, so that the third brood of *Asemum* has very little chance of completing its development.

A few however succeed in finding their ways to the thin rootlets, and I have found in upturned stumps in the New Forest, the insect in all its stages; the rootlets sound but sometimes no thicker than one's little finger, the whole of the decayed part of the stump including the larger roots being given over to *Rhagium*.

Since the discovery of this colony I have found a great number of colonies of *Asemum* scattered all over the New Forest and in remote corners of Hampshire and Dorset,

and I have always observed that the insect is closely followed up by *Rhagium*.

It is thus clear that *Asemum striatum* and *Rhagium bifasciatum* together constitute one of the most potent (though unobtrusive) helps to forestry. For there is good reason for supposing that there is never a considerable number of Scotch firs felled in the New Forest but these two insects turn the opportunity to good account and speedily reduce the stumps to manure.

The former ever retreats before the progress of decay until retreat is no longer possible, while the latter delights in decay and feeds on decaying wood until it thus reduces the whole stump to powder, with the exception of the thinnest layer of outer wood which hides its depredation within. It often happens that a stump, the upper-surface of which is covered with *Asemum* holes, and would appear to contain larvæ of that insect, when tapped, completely collapses and appears but a mass of dust and manure. *Rhagium* is not what we may call a hard-working insect and does not make a hole of exit unless necessary, but uses any convenient fissure, or the holes of *Asemum*, for the purpose of exit.

The life-cycle of *Asemum* is as follows, viz. :—

At the end of May or early in June, a number of eggs are inserted between the scales of the bark on the sides of the stump or exposed portions of the thick roots. The young larvæ soon hatch and for some time feed on the bark itself. Having worked their way through the bark they do not bore between the bark and the wood as the *Callidiidæ* do, but penetrate through the outer layer of wood, when, if they were deposited in the side of the stump, they commence working downwards, just under the surface of the wood, making as they proceed galleries, the calibre of which is in one direction slightly larger than their own bodies and in the other direction much wider. These galleries wind about and their margins are more or less tortuous. The larvæ when about half-grown have proceeded some distance down the stump, and they then connect the burrows with the outside by means of small holes. Up to this point, as they progressed, their galleries were completely and tightly filled behind them with wood-dust and refuse, which they had compressed so tightly that when dry it is almost as hard as the surrounding wood. Till this period, the decay of the stump

has not been at all hastened by these larvæ, for they have left behind them no communications that would facilitate the entrance and growth of mildew.

There are no punctures in the bark, and when this is removed there are generally no traces of borings on the inside of the bark, nor on the surface of the wood. The small borings through which the larvæ entered the wood itself are filled up and become almost imperceptible.

Owing to this absence of orifices, even though a stump may contain a great number of larvæ in this stage, one not acquainted with their habits would be most likely to overlook them.

But having made its communication with the exterior the larva's efforts have an additional object, for from henceforth they are partly directed towards making suitable provision for itself during its later stages. It for a time continues to bore downwards but with a more inward direction, and instead of compressing the refuse behind it as it previously did, it forces it through the orifice alluded to.

After pursuing this method for some time it concludes its downward course and enlarges the end of the burrow so as to form a sort of turning-space. This may be anything between eight to fifteen inches below the flat surface of the stump. The larva now changes its direction and strikes upwards, with a burrow which has a calibre somewhat more corresponding with the shape of its body, and also straighter than its downward burrow.

An upward burrow may at once be distinguished from a downward one by the fact that the latter is almost imperceptible on account of its being tightly filled with refuse, while the former is visible as it is free from *debris*.

When the larva has brought its gallery very close to the outside of the wood, it discontinues the gallery and pushes into the dome-shaped termination thereof a number of long wood-fibres, which it tightly compresses together. If this be not done to keep out the rain, I cannot suggest any other purpose.

In this completed and unobstructed upward-burrow, the larva lives for a considerable time, for I have found completed burrows in October, while the insect does not pupate till the following spring.

During this period it gradually ceases its activity and becomes whiter in colour. It pupates in May, remaining

in the pupa state about three weeks. The pupa is very active. It has no cocoon, but can use the whole of its upward-burrow (up and down which it frequently travels) for the purpose.

The extremity of its abdomen is provided with two long sharp spines which assist in this operation.

The way it progresses is interesting. It curls the extremity of its body underneath it, with the result that one of the spines becomes fixed into the side of the burrow. It then straightens itself. This operation continually repeated constitutes its mode of locomotion. Minute down-curved spines on the dorsal side of the abdomen prevent it from slipping down its burrow when stationary. A noteworthy point in reference to these spines is that they are the only hard and dark parts in the pupa immediately after its metamorphosis from the larva.

Apparently its object in travelling up and down its burrow is to prevent the growth of mildew upon its walls. I have observed that in glass tubes containing these and other Longicorn larvæ the galleries when occupied by healthy larva or pupa are immune from mildew, while the other parts of the wood may be badly infested.

It will be recalled that the pupa of the clear-wing moths are provided with serrations on the margins of their abdominal plates to assist them in travelling up and down their burrows in a similar manner.

These spines serve an additional purpose, for they assist the pupa in the initial stages of casting its skin, by enabling it to hold its body more rigid and in greater tension, while splitting open the thin skin at the back of its neck. It will thus be seen how necessary it is in rearing these and allied pupæ, to put them in tubes which afford them the same facilities for doing this as their native burrows do.

I have lost more pupæ from exhaustion in seeking to split this thin skin than from any other cause.

After undergoing its final metamorphosis *Asemum* matures rather rapidly.

The imago opens the roof of its prison when almost mature.

Seeing that their burrows are the only places where one can hope to find these insects, it seems pretty certain that when possible they always hide in them during the daytime, affording as they do such excellent retreats.

Asemum sometimes attacks standing trees, but only when the trees' vitality has been impaired. In such cases the upward borings are often much shorter than when the insect attacks stumps.

There is no fear of *Asemum* spreading from sickly trees to healthy ones, and the greatest inducement for it to attack is if the trees are burnt round the roots.

CRIOCEPHALUS FERUS.

My investigations in connection with *Asemum striatum* led to my exploring the Scotch fir woods of the New Forest.

In June 1902, in a grove of large trees, I observed a number of conspicuous holes in the trunks between a foot and fifteen inches from the ground. They were very like *Asemum* holes, distinctly oval and clean-cut, but the majority were much larger. Although it was raining heavily I proceeded to investigate the cause. In an hour or two I was rewarded by securing fifteen or sixteen large larvæ which looked much like *Asemum* larvæ but which I clearly saw were different. I supposed that the insect must be *Hylotrupes bajulus*. I was therefore much surprised when early in August I reared from them a long brown insect which certainly was not *Hylotrupes*. I at once searched the Birmingham libraries for information, and found in W. Rothschild's "Musée Entomologique Illustré" a short description and figure of *Crioeephalus rusticus*. I concluded that that was my insect, and accordingly so labelled it in my collection. Towards the end of the same month another emerged, and the only surviving larva, showing no sign of pupation, continued to burrow in its piece of wood. The reason I lost so many larvæ at this time was that at the time of capture I had not sufficient receptacles to enable me to keep each one separate. The larvæ proved to be very active and irritable, and in consequence before I arrived home all except three had received injuries.

Early in 1903 I made the acquaintance of Mr. Willoughby Ellis and informed him that I had taken *Crioccphalus* in the New Forest, and after seeing my specimens and the surviving larva, he accompanied me to the habitat. He subsequently wrote an article on the subject which appeared in the "Ent. Recd.," 1903, xv, 259.

In setting forth what I know of the life history of this insect, with which I subsequently became more fully acquainted, I will, in order to avoid repetition, mention chiefly those respects in which it differs from that of *Asemum striatum*.

In the first place, it attacks large trees that are standing and growing. When I discovered its habitat, the trees appeared in no respect to differ from the surrounding ones, but we now believe the vitality of these trees was somewhat impaired by some cause or other.

The wood in which the larvæ were boring was by no means dead; for when cut, sap freely exuded.

A careful examination revealed the fact that some of the roots were dead or dying and inhabited by *Asemum*.

The holes of *Criocephalus* are usually further from the ground than in the case of *Asemum*, when that insect attacks trees.

Judging from the length of time that the larva appears full grown and lives in its completed burrow it would appear to be much longer-lived than *Asemum*.

The following, in addition to other evidence I have gathered, proves that this larva lives for a very considerable time in its completed burrow, viz.: early in August of last year I carefully opened two completed burrows which ran side by side; the unobstructed portion of each was of similar length, and I did not observe any difference. Each contained a larva; one of these was about to pupate, while the other, judging from its sluggish movements, appeared to be rapidly approaching that condition. I concluded that both would provide imagos last year. The former however pupated, while the latter simply underwent a larval ecdysis, and I hope to rear it this year; also the largest larva I have ever seen I procured at that time, but it will not mature till next August.

I am of the opinion that *Criocephalus* while in the larval state always makes a hole for its exit as an imago and stuffs up the entrance with gnawed-down bark. I do not consider however that I have sufficient evidence to be quite positive on this point. It is interesting to note however that *Criocephalus* forces a very much larger quantity of material into the end of its burrow than *Asemum* does, the stopped-up part sometimes extending right through the bark and into the wood itself where long wood-fibre is used.

This wood-fibre is quite different from any refuse found lower down its burrow and is only used for this purpose. When the bark is very thick the larva pupates in the bark itself, stopping up this portion of its gallery at each end. When it pupates in the wood it reserves a considerable portion of its burrow for its final stages and the pupa travels up and down as that of *Asemum* does.

Another interesting point about the burrows of these larvæ, and one which also shows that the larva lives for a considerable time in that portion of its burrow which may be termed its pupa-case, is that near the hole of exit the larva makes a short off-shoot, into which it pushes one of its discarded skins, and carefully covers over the entrance to it with wood-dust. The result of this performance is to place out of reach an object which would encourage the growth of fungi. In one of my specimens of these pupa-cases the annex containing the skin is full of mildew and putrefaction, while the pupa-case itself is quite free from any such thing.

Another noteworthy fact in the economy of this insect is the extreme lateness in the season at which the perfect insect appears. It apparently never undergoes its final metamorphosis in this country till about the end of July, although Dr. Sharp reared a specimen in June of last year. I think there is no doubt however that this was due to the high temperature of the room it was kept in and to its proximity to the fire. Having cast its pupal skin it is at the very least a fortnight before it is ready to leave its hiding-place. In large, well-developed specimens, it takes quite a considerable time for the distended abdomen to sufficiently contract not to be an impediment to the insect and to come within the limits of the elytra.

Having matured, it leaves its prison as the twilight is giving place to darkness.

It has been thought that it is a sluggish insect, but so far is that from the case that I believe it to be second to none of the British Longicorns for fleetness of foot and agility of wing. There seems no difference between the sexes in this respect. They both continue to fly and run about at a great rate late into the night.

I kept several alive last year and they all died about one month after maturing. They came from their hiding-places regularly at the same time every night, and once or twice I looked at them after 12 o'clock, and found

them still active. I succeeded in breeding with one pair, and have at present some of their offspring in a piece of bark.

I have on two or three different occasions observed them flying about in their natural habitat, and noted that the time at which they appeared was the same as in the case of specimens in captivity.

The eggs look exceedingly like those of the common blow-fly and are thrust deep down between the laminæ of the bark to which they are cemented. A female does not deposit many more than fifty or sixty eggs.

During the daytime the insect is perfectly inert, almost to the point of feigning death. It may be said to be at large from the middle of August till the middle of September, although I have specimens which did not cast their pupal skins till September.

I consider that the following considerations are responsible for this insect not having been observed previously :—

i. The comparative rarity of suitable habitats.
ii. The great difficulty in securing the perfect insect (though the habitat may be known) on account of its nocturnal habits and its great resemblance to the bark among which it hides.
iii. The difficulty in securing the larvæ owing to the very hard wood into which they bore.
iv. The unusual lateness in the season at which it appears.
v. Its probable confinement to one spot for a great number of years.
vi. The fact that pine woods in S. England have till lately been almost entirely ignored as unproductive by Coleopterists.

Most of the above considerations are doubtless responsible for the fact that *Ascmum* up till 1902 was almost unknown as an inhabitant of Great Britain south of the Border. But as it does not appear "out of season" as *Criocephalus* does, and is so very much more common than that insect, it is indeed remarkable that it has not been better known by British collectors before.

Before bringing these notes on the habits of these two interesting insects to a close I must take this opportunity

of expressing my great indebtedness to Dr. Sharp, who has put every possible facility in my way to help me to complete my knowledge of these insects, and apart from whose generous assistance it would have been impossible for me to have contributed this very small item to the stock of entomological knowledge.

My thanks are also due to Mr. Ellis, Mr. Colbran J. Wainwright, and Mrs. Lamb of Brockenhurst, for help I have received in various ways.

VIII. *On the matrivorous habit of the species of* Heterogynis, Rmbr. By T. A. Chapman, M.D., F.Z.S.

[Read February 1st, 1905.]

In presenting these notes in extension of my previous papers on *Heterogynis*, Rmbr., the regret, I must acknowledge, in having to correct an error I had fallen into but slightly modifies the satisfaction I have in having at length made certain observations, which I ought no doubt to have made before, and in fact narrowly escaped making. The satisfaction results not so much from the somewhat remarkable nature of the observations themselves, as from the circumstance that they appear to explain the object to be attained by, and therefore the forces in action that evolved, the very anomalous specialization of the female imago in this genus, and relieves us from having to regard them as isolated and inexplicable phenomena.

In my paper on *H. paradoxa* in the Transactions of the Society, 1902, pp. 717–718, I said that the young larvæ of that species "hibernate by spinning a small cocoon in some crevice of the food-plant or elsewhere. *H. paradoxa* does this, I find, in the second instar; Mr. Fletcher found *H. penella* did so in the third. Whether there is here a real specific distinction I cannot say, or whether there may be an error of observation on my part, or Mr. Fletcher's. The newly-hatched larva of *H. penella* is certainly much smaller than that of *H. paradoxa*." Again, p. 726, I wrote, "The newly-hatched larvæ present very important differences that have perhaps more specific value than any others." I then proceed to describe certain differences in the possession of stellate hairs by *paradoxa* which are not to be found in *H. penella* until the second instar.

This year I met with *H. paradoxa* at La Granja; I was too late for larvæ or moths, but found cocoons, from some of which the larvæ had already hatched, from others of which they emerged after I took them. Perchance the want of the more interesting stages made me attend more closely to the material I had. The result of my observa-

tions is that the passages I have quoted above from my previous paper on the species, are quite correct, if, by "hatching," one means the emergence of the young larvæ from the pupa-case and cocoon of their mother. But as the true meaning of the word is emergence from the egg they are all wrong. *Hinc illæ lachrymæ*, though I rejoice more over the correction than I weep over the error.

The actual facts are that in all the species the newly-

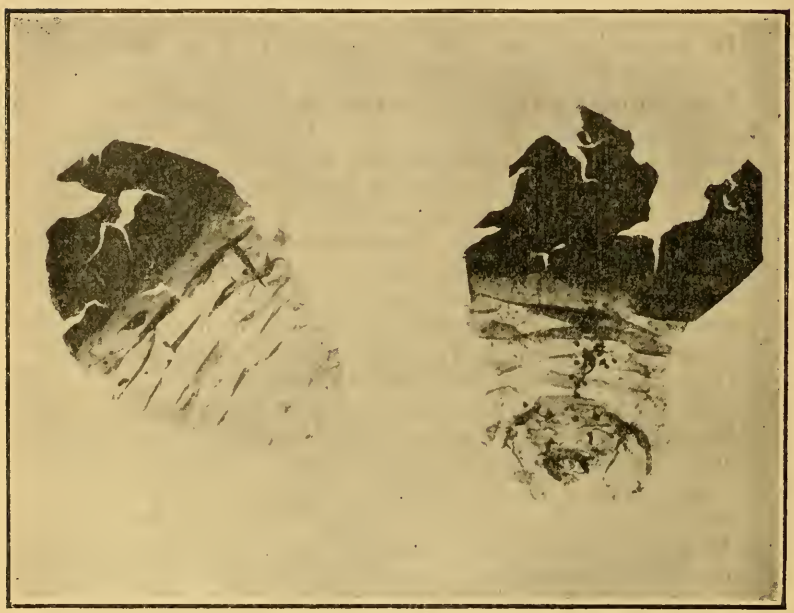


Fig. 1.

hatched larvæ are very similar; in all, their first pious duty is to eat the remains of their mother.

Having done this, *H. pcnella* and *H. canalensis* perforate the maternal pupa-case with various openings and make their escape. An examination of the empty pupa-case they have left shows it quite clean and containing only a very few threads of silk entangling a small but varying number of small greyish pellets, which I take to be urates or some similar effete product of the dead mother. In *H. paradoxa*, for some reason, the procedure is different, probably because the mother is much larger than in the

other species, and the difference in size is largely expressed not in the size or number of her eggs, but in the mass of eatable materials she represents after her decease. At any rate the young larvæ get larger than do those of the other species, and undergo their first moult before penetrating the pupa-case and cocoon and venturing to appear at large.

A pupa-case of *H. paradoxa* ♀, from which the young

Fig. 2.

larvæ have emerged, presents a dirty and muddled aspect due to the presence of a good deal of spinning by the young larvæ, amongst which the skins they cast at their first moult are entangled.

A very interesting point is that there is no trace of larval frass present in either species. This one can more easily understand perhaps in the case of *H. penella*, where the total amount of maternal tissue is small, and each larva gets but little, as evidenced by their small size on emerging from the parent cocoon. But in the case of *H. paradoxa* the amount must be considerable, as the larvæ grow very

appreciably, in fact about double their size, besides going through a whole instar and making a moult.

I am afraid that in my previous observations, made in the first place hurriedly in the field, and not afterwards properly verified, I mistook the heads of the cast skins for larval frass, and assumed some such amount of frass to be what one would reasonably expect after their first meal of the maternal tissues. In *H. paradoxa* one finds, however, nothing but some threads, the cast larval skins (skins as well as heads), and the pellets of urates, which from their small number and comparatively large size are obviously maternal and not larval *débris*. The young larvæ therefore go through a whole instar, more than double their size, undergo a moult, and then perforate the pupa skin, and make their way through the cocoon without ejecting any frass or effete material. It seems to follow that the maternal remains must consist almost entirely of completely assimilable materials. As the larvæ on facing the world have to begin life in many cases by making a long journey to find their food-plant, a meal before starting is an obvious advantage, but this does not explain the curious details of the process, or why it should differ in the several species.

I should note that I have examined just now pupæ of *paradoxa* and *canalensis*, but have no adequate specimen of *penella* by me. With regard to it, therefore, I merely assume from my previous observations of it that it agrees with *canalensis*.

It results that at corresponding instars the larvæ of the several species are very much alike, it also follows that the discrepancy between Mr. Fletcher's observations as to the hibernating instar of *H. penella* and mine of *H. paradoxa* does not exist, though it is my fault that there appeared to be one.

The distinction I drew between the first instar larvæ of *H. penella* and *H. paradoxa* does not exist as a structural difference at all; nevertheless there is a difference between them in habits and instincts, which is probably of quite as great importance.

The only other matter I observed this year at La Granja as regards *H. paradoxa* was that it had two widely-separated habitats, one at about 5200 ft. elevation, where its food-plant was *Adenocarpus hispanica*, the other at about 7000 ft. on *Cytisus purgans*; the opportunity was wanting

to determine whether there was any varietal distinction between the two races, but this is very probable, as the intermediate country and elevations were without any "broom" capable of nourishing the species, so that the two colonies were probably segregated with considerable strictness.

The extreme development of the matrivorous habit in *H. paradoxa*, and its obviously great importance in the economy of the species, afford an explanation of the remarkably aberrant habits and structure of the female imago, and give us some hints as to the probable steps by which they were evolved.

Though the latter are more or less hypothetical, and therefore less certain than the former, we may take them first, as they are so in point of time.

We may safely assume that the first steps in the process of evolution were similar to those that obviously obtained in *Psyche* and *Orgyia*. Firstly, apterousness of the ♀ consequent on laying the eggs, on or in the cocoon or close by. Then eggs laid in the pupa-case. And somewhere at this point the dominating conditions would probably be those which I imagined still to obtain, as no doubt subsidiarily they do, when I discussed this matter in connection with *H. penella* (Ent. Trans., 1898, p. 46), viz. protection of the eggs from enemies and from desiccation by the mother dying in and blocking the open end of the pupa-case. At this time the moth probably still retained some legs and some scales or hairs. Both Psychids and Orgyias still retain some hairs, so far as I know, in all cases.

The delicate nature of the eggs (as in the allied Anthroceras) would make protection against drought a strong selective agency, and there would now come in the matrivorous instincts of the larvæ. These no doubt would originate accidentally in the necessities of the larvæ finding a way of escape from the pupa-case, leading some of them to do so by eating into, or at least nibbling the dead body of the ♀. So soon as matrivoracity became definitely an instinct then several forces would come into action. As these would be the same that now keep the arrangements in their present perfection we may better consider them in connection with the explanation they afford of existing facts. The very complete closure of the pupa-case, so that it looks as if it had never been opened, and no moth ever emerged from it, becomes very important when we regard

the body of the moth no longer as a second line of defence, but as a store of food to be kept from enemies gross or bacterial, from drying up, and from other dangers. The precautions for the moth getting safely back into the pupa-case, apparently rather a hopeless matter considering its maggot-like structure, become more obviously matters of necessity, leading up to the organic connection the moth has with the pupa-case at the sites of the atrophied legs. The brief time the moth remains out of the pupa-case, less probably sometimes than five minutes, is not only important as minimizing the period of exposure to enemies, but also as a period of deterioration of the moth as a food material.

We next come to the extraordinary structure (or want of structure) of the moth itself. Everything aims at the whole available forces and materials possessed by the larva when it spins its cocoon being devoted to egg formation on one hand and larval food on the other, and further that the last object hardly takes a second place. If we compare the female *Heterogynis* with those females of the Psychids in which the structures have most degenerated, we find that in the Psychids everything has given way to egg development. The protection of the eggs is achieved chiefly by mixing them with the hairs from the maternal surface, and the female drops out of the case after she has laid her eggs as a mere scrap of chitin, with considerable masses of urate sand some little fluid. There is, in fact, nothing whatever edible. In *Heterogynis* no hairs are used to protect the eggs, and not only is the ♀ devoid of hairs and scales, but the cuticle is a simple membrane without traces of the bases of hairs or scales, without any skin points or other structures, and if I said actually without chitin, I think I should commit no large error demonstrable in a chemical balance. In the next place, the urates are very small in amount. The quantity which most insects void on emerging from the pupa is very considerable, partly left in the pupa-case, partly voided after the wings are expanded; it is usually in solid particles suspended in fluid; there is usually some excess fluid to be got rid of after the wings are expanded. Why are these urates less in the case of *Heterogynis*? If I am asked are they really so, I must admit that I am not prepared to meet the question, as having weighed the material in question. But the thing seems to me to be

so obvious, comparing the few pellets remaining from *Heterogynis*, with the deposits usual in most moths of similar size, that the matter is self-evident. The urates represent the amount of tissue waste that has taken place. Now in *Heterogynis* this tissue waste is that involved in the muscular exertion of spinning the cocoon, in casting the larva skin, and in the emergence and retreat of the moth, and in laying her eggs. The whole process of histolysis and development by which the larval structures are absorbed, and the imaginal (wings, legs, hairs, scales, antennæ, etc.) are built up from their embryonal condition is completely saved; this process must in ordinary Lepidoptera require a good deal of expenditure of tissue material. In *Heterogynis* not only are no imaginal structures developed, but the larval skin muscles and the larval colouring remain unchanged. I have already noted the skin to be devoid of the usual skin points, but there are in fact no hard parts whatever, no head plate, no prothoracic plate, no appendages, no solid parts to the ovipositor, etc. Everything is eatable, and all is eaten; I do not think we can find in the imaginal composition any explanation of why the larvæ void no excreta during a whole instar, and until, during the second instar, they have made their escape from the parental cocoon.

This is probably a matter of hygiene, by which the presence of such excreta would be most undesirable amongst the crowded larvæ, especially if their emergence were delayed by any climatic or other causes. The case of such larvæ as those of *Cnethocampa*, whose nests are loaded with frass, are hardly parallel, since these nests are very roomy, and the portion into which the larvæ crowd are more or less free from frass, whilst in the *Heterogynis* pupa-case the larvæ are solidly wedged together with no spare space and very few threads of silk. That there shall be no frass, however, that the larvæ shall not require to void anything, it is no doubt necessary that the pabulum shall be of a most concentrated and digestible nature.

Summarizing the facts now advanced, there is first the correction of the error as to first stage of *H. paradoxa*, due to the recognition of the circumstance that it does not emerge from the maternal pupa-case and cocoon till it has moulted into the second instar. Secondly, the importance in the economy of the genus, and especially in *H. paradoxa*, of the matrivorous habit, all the details

connected with which are elaborated to a degree, and of which the remarkable structure of the female and her way of life, are items which it very largely explains. I cannot call to mind any other Lepidopteron with such a matrivorous habit.

Description of Figures.

Pupa-cases of *H. canalensis* (fig. 1) and *H. paradoxa* (fig. 2) longitudinally divided and placed on slides—all contents preserved. Photographs by A. E. Tonge, Esq. The amplification is four diameters.

The *H. canalensis* pupa has no contents, but a few grey pellets of maternal urates.

The *H. parodoxa* has similar pellets, but also contains larval skins, of which the heads are very conspicuous, cast on their first moult by the young larvæ. There is no larval frass. There is in neither case any trace of the mother except the pellets of urates.

The more solid abdominal ends of the cases are split irregularly.

IX. *Descriptions of some new species of* Satyridæ *from South America.* By Frederick Du Cane Godman, D.C.L., F.R.S., etc.

[Read March 1st, 1905.]

Plate X.

I take the opportunity of describing the following apparently new species of South American Satyridæ, which have been for some time unnamed in my collection, before handing them over to the Natural History Museum.

Pierella chalybæa, sp. n.

Very similar to *P. lamia*, Sulz., but differs in having rather more than the basal half of the hind-wings in both sexes suffused with steely-blue, the black rings round the submarginal row of white spots is almost or quite absent, the outer margin of these wings is very broadly infuscate, and the two inner lines crossing the disc are faint.

Hab. Brazil, Chapada (*H. H. Smith*).

I have two males and one female of this *Pierella*, which seems sufficiently distinct to require a separate name. The steely-blue suffusion of the basal area of the hind-wings is strongly marked in both sexes. This character also distinguishes it from *P. rhea*, Fabr.

Euptychia analis, sp. n. (Plate X, fig. 1, ♂.)

♂. Very like *E. batesi*, Butl.; above faintly suffused with purple and the hind-wings with a conspicuous patch of dark blue scales at the anal angle, the two reddish-brown bands beneath broad and visible from above.

Hab. Amazons, San Paulo and Tapajos (*Bates*); Peru, Pebas (*Hawksley*).

Three males. This appears to be a form of *E. batesi*, which also occurs at Tapajos, differing from it as indicated above.

Euptychia stigmatica, sp. n. (Plate X, fig. 2, ♂.)

♂. Very similar to *E. cærulea*, Butl., but paler blue, the primaries with an elongated brand about the middle of the inner margin composed of intermixed white and reddish-brown scales, the broad blackish border less sharply defined, the transverse blackish streak beyond the cell distinct; beneath bluish-grey, the lines crossing the wings broader.

Hab. ARGENTINA, Entre Rios (*H. H. Smith*).

One specimen. This insect in size, colour, and marking resembles the female of *E. cærulea*, but wants the inner submarginal line on the secondaries and the line crossing the cell on the primaries. The male has a very conspicuous elongate brand at the middle of the inner margin of the primaries, a character not found in *E. cærulea*. There is also a male of this species in the Hewitson Collection at the British Museum; it is labelled "Rio River." A female placed with it in the same collection no doubt belongs here.

Euptychia penicillata, sp. n. (Plate X, figs. 3, 3*a*, ♂; 4, ♀.)

♂. Greenish-plumbeous, the primaries with a dense pencil of long coarse brown hairs below the origin of the first branch of the median nervure; beneath greenish-brown, crossed by two common dark brown lines, and with the usual wavy submarginal line of the same colour, the primaries with three small ocelli, the subapical one conspicuous, the others indistinct; the secondaries with a series of five ocelli, the second and last large and the others small.

♀. Uniform brown above; beneath as in the male, but the ground-colour pale brown, becoming greyish towards the outer margin.

Hab. AMAZONS, Tapajos (*Bates*).

One pair, which I have had for many years unnamed in my collection. The male has a tuft of hairs on the fore-wings as in the same sex of *E. pilata*, Butl., the hairs themselves being coarser than in *E. umbrosa*.

Euptychia scopulata, sp. n. (Plate X, figs. 5, 5*a*, ♂.)

♂. Allied to *E. penicillata* and having a similar tuft of hairs on the fore-wings, but of a browner hue above; beneath greyish, the two common lines crossing the wings broader and of a red-brown colour, the primaries with two ocelli only.

Hab. Upper Amazons.

Dr. Staudinger has sent me a single male example of this insect, which for some time has been placed with the preceding species in my collection. Although very like *E. penicillata* it differs considerably on the under-side.

Euptychia mimas, sp. n. (Plate X, fig. 6, ♂.)

♂. Uniform dark-brown; beneath paler, crossed by two dark-brown lines and with a narrow, wavy, similarly coloured submarginal line, the primaries with a series of two or three small ocelli, that nearest the apex the most distinct, the secondaries dusted with ochreous scales and with a series of five bipupillate ocelli, the second and fifth black within.

Hab. Bolivia, Coroico, 6500 ft. (*Garlepp*).

Three examples. Near *E. phineus*, Butl., from Venezuela.

Euptychia boliviana, sp. n. (Plate X, fig. 7, ♂.)

♂. Bright-brown; beneath paler, primaries with a broad ochraceous band extending from the anal angle and becoming less distinct towards the apex, a wavy submarginal dark line, and two or three very minute white spots towards the apex; secondaries, except at the base and outer margin, thickly covered with whitish scales, crossed by two irregular ochraceous submarginal bands, three strongly angulate dark lines (two crossing the disc, the third submarginal), and a series of minute white dots.

Hab. Bolivia, San Jacinto, 6000–8000 ft. (*Garlepp*).

Two specimens. This is a species of large size, uniform bright brown above, and peculiarly marked beneath.

Euptychia (?) *bioccllata*, sp. n. (Plate X, fig. 8, ♂.)

♂. Uniform brown, the primaries with a double black ocellus towards the apex enclosed in an ochreous ring; beneath paler, the ocellus more conspicuous and surrounded by a dark line, which becomes faint at the apex and forms an angle towards the inner margin, the space between it and the outer margin marked with grey; secondaries with two broad grey bands crossing the wing, one just beyond the cell (bordered internally by a dark line), the other close to the margin and extending along the inner margin to the base, the cell also crossed by a faint dark line about the middle.

Hab. Bolivia, Tanampaya, 6000–8000 ft. (*Garlepp*).

Three specimens of this small species have been sent me by Dr. Staudinger. It will perhaps prove not really

to belong to *Euptychia*. There are, however, several members of that genus similarly coloured on the upper-side, but the present insect differs from all of them in the marking of the under-side of the secondaries.

Lymanopoda maso, sp. n. (Plate X, fig. 9, ♂.)

♂. Uniform brown ; beneath as above, the primaries at the apex and the secondaries towards the inner margin dusted with lilac scales, the primaries with a submarginal series of minute white dots, the secondaries with a curved series of six or seven whitish pupillated spots running from the apex to the anal angle. Primaries truncate at the apex, secondaries dentate on the outer margin.

Hab. COLOMBIA, Frontino in Antioquia (*T. K. Salmon*). Four specimens. The shape of the wings and the conspicuous row of white spots on the secondaries beneath readily distinguish this insect. *L. albomaculata*, Hew. (= *apulia*, Hopff.), has a somewhat similar row of white spots on the under-side of the secondaries, but in that insect the wings are differently shaped.

Lymanopoda malia, sp. n.

Very similar to *L. acræida*, Butl., but the secondaries also with a conspicuous submarginal row of fulvous spots.

Hab. PERU, Rio Colorado (*Watkins* and *Tomlinson*), Pozuzo (*Pierce*).

This is a form of *L. acræida*, Butl., but as it appears to be restricted to Peru I have ventured to give it a name. *L. malia* is not uncommon, though hitherto I have not seen a female of it. The Ecuador specimens of *L. acræida* in my collection are much smaller than those from Bolivia, though they do not otherwise differ.

Lymanopoda levana, sp. n. (Plate X, fig. 10, ♂.)

♂. Dark brown, primaries and secondaries each with a small pupillated black spot near the anal angle, and one or two minute white dots above it parallel with the outer margin ; beneath, primaries as above, but with the apex broadly ferruginous, secondaries ferruginous, an ochreous band (outwardly dentate, inwardly evanescent) crossing the wing from about the middle of the costa to the anal angle, the dots as above.

Hab. COLOMBIA, Bogota (*Chapman* and *Wheeler*).

Two specimens. This is a small species, with somewhat pointed primaries, very dark brown above, and with the secondaries peculiarly marked beneath.

Pedaliodes albonotata, sp. n. (Plate X, fig. 11, ♂.)

♂. Blackish-brown, primaries with a transverse quadrate white patch crossing the cell obliquely, two spots beyond this (one towards the apex, the other towards the anal angle) also white; beneath as above, the apex of the primaries and the whole of the secondaries mottled with white, the two outer spots on the primaries as above, but smaller, the secondaries with an irregular transverse W-shaped mark at the apex, a spot about the middle of the costa and another near the anal angle also white. The cilia of the primaries spotted with white.

Hab. Venezuela, Merida (*ex Staudinger*).

Two males of this well-marked species were sent me some years ago by Dr. Staudinger. One of the specimens has, on the upper-side, a minute white dot between the two submarginal spots on the primaries and another near the apex of the secondaries. There are also two examples of *P. albonotata* in British Museum, both from Venezuela, one from Culata, the other from Pedregosa; these have the two submarginal spots on the upper-side of the primaries almost or quite obsolete.

Oxeoschistus duplex, sp. n. (Plate X, fig. 12, ♂.)

♂. Dark-brown, an ochreous band running from near the apex of the primaries and widening till it reaches the anal angle of the secondaries, the band marked with a series of large rounded dark brown spots, its outer margin strongly dentate on the secondaries, thus forming lunules, which are bordered externally with ochreous; beneath, primaries paler than above, ferruginous at the apex, the costa towards the tip streaked with white and yellow, the outer margin also faintly spotted with yellow; secondaries obscure ferruginous, a transverse white line from the costa crossing the middle of the cell and extending to near the inner margin, the submarginal band darker than above and also bordered on both sides with white, the black spots pupillate.

Hab. Bolivia, San Jacinto (*Garlepp*).

The single example I possess of this species was sent me long ago by Dr. Staudinger under the MS. name of

O. duplex. It is a close ally of *O. puerta*, Westw., from Costa Rica, Colombia and Venezuela, but differs from it chiefly in the very strongly dentate outer margin of the band on the secondaries, and in the large size of the spots on both wings. There are also two males of this insect in the British Museum, both from Bolivia.

Explanation of Plate X.

Fig. 1. *Euptychia analis*, ♂.
2. ,, *stigmatica*, ♂.
3. ,, *penicillata*, ♂.
3*a*. ,, ,, tuft of hairs on the fore-wing, ♂.
4. ,, ,, ♀.
5. ,, *scopulata*, ♂.
5*a*. ,, ,, tuft of hairs on the fore-wing, ♂.
6. ,, *mimas*, ♂.
7. ,, *boliviana*, ♂.
8. ,, (?) *biocellata*, ♂.
9. *Lymanopoda maso*, ♂.
10. ,, *levana*, ♂.
11. *Pedaliodes albonotata*, ♂.
12. *Oxeoschistus duplex*, ♂.

X. *Additions to a knowledge of the Homopterous Family* Cicadidæ. By W. L. Distant.

[Read March 1st, 1905.]

Plate XI.

Being engaged in an attempt to revise the classification of the *Cicadidæ* and to prepare a synonymic catalogue of the Family, I have been entrusted with much material belonging to other collections in order that my purview may be as extensive as possible. I have thus come across a number of undescribed species, and this paper refers only to those belonging to the subfamily *Cicadinæ*. Of these I found in the collection belonging to the Paris Museum, some beautiful species from Madagascar, which are probably among the finest in the whole family *Cicadidæ*. A striking species of *Pycna* from Natal, is from the Stockholm Museum.

Family CICADIDÆ.

Subfamily *CICADINÆ*.

Div. Polyneuraria.

Sadaka hyalina, sp. n.

♀. Body brownish-ochraceous; head with a large central spot, an anterior transverse line and linear margins to front, and a somewhat broken transverse fascia between eyes, black; pronotum with the lateral margins, a central longitudinal line widened anteriorily, a central transverse spot in front of anterior margin, and the incisures, black; mesonotum with four obconical spots, the two central smallest, a central lanceolate spot and a small spot in front of each anterior angle of the cruciform elevation, black; basal segmental abdominal margins black; the central sulcation to face, a fascia between face and eyes, and apex of rostrum black; tegmina and wings hyaline, venation ochraceous, inclining to fuscous outwardly; tegmina with the costal area and membrane ochraceous, the last containing two piceous spots; upper half of basal cell, and basal half of claval area piceous. Head including eyes about equal

in width to base of mesonotum; head as long as pronotum excluding posterior margin, lateral pronotal margins angularly ampliate; rostrum reaching the posterior coxæ.

Long. excl. tegm. ♀ 18 millim. Exp. tegm. 58 millim.

Hab. W. Africa; Guinée Français (Paris Mus.).

Munza revoili, sp. n. (Plate XI, fig. 5, *a*, *b*.)

♂. Head above piceous-black; a spot at base of antennæ, eyes, ocelli, and a large transverse spot between area of ocelli and eyes, ochraceous; pronotum ochraceous, the margins flavescent, a posteriorily broad central triangular fascia to disk, the incisures, and sometimes extreme lateral margins, piceous-black; mesonotum testaceous, with four large obconical black spots, the two intermediate spots smallest; abdomen above brownish-testaceous; body beneath and legs more or less testaceous; an anterior black fascia between face and eyes; anterior tibiæ piceous; tegmina with about basal half creamy opaque, with obscure pale fuscous spots or mottlings, basal cell with its anterior and apical margins piceous, apical half of tegmina subhyaline, talc-like; a macula fascia extending across the bases of 1–5 apical areas, a similar fascia at apices of apical areas, broken on lower apical area, and more or less extending to outer margin; wings umber-brown and outwardly piceous for about two-thirds their breadth from base, the anal area dark fuscous, the venation piceous. Head including eyes slightly wider than base of mesonotum, the lateral pronotal margins broad and medially angulate; abdomen much narrowed posteriorly; rostrum reaching the posterior coxæ; opercula transverse, centrally overlapping, margins moderately convex, just reaching base of abdomen.

Long. excl. tegm. ♂ 26 millim. Exp. tegm. 77 millim.

Hab. Somaliland; Ouarsangueli (Revoil—Paris Mus.).

Platypleura spicata, sp. n.

♀. Body brownish-ochraceous, thickly and longly greyishly pilose; head with the area of the ocelli, two transverse lines on the lateral margins of vertex, and an anterior marginal line to front, black; pronotum with two central lines fused posteriorly but not extending across the posterior margin, and the incisures, black; mesonotum with four medial obconical spots on anterior margin, an elongate lateral spot on each side, and a spot at each anterior angle of the cruciform elevation, black; tegmina and wings pale hyaline, a little talc-like; tegmina with a spot on costal membrane and area near

base, a small spot just beyond basal cell, some short shadings on the longitudinal veins to ulnar and apical areas and the same on the transverse veins at bases of most of the apical areas black. Head including eyes about as wide as base of mesonotum ; the lateral margins of the pronotum strongly angularly ampliated, their apices acutely spinous and a little anteriorily recurved ; the greyish pilosity particularly developed on the mesonotum and abdomen, on the last forming distinct long segmental margins ; the face is more or less piceous, very strongly longitudinally sulcated, its lateral areas transversely ridged ; rostrum reaching the posterior coxæ, its apex piceous ; intermediate and posterior femora longitudinally and linearly streaked with fuscous beneath ; anterior femora obtusely spined beneath.

Long. excl. tegm. ♀ 22 millim. Exp. tegm. 76 millim.

Hab. MADAGASCAR ; Majunga and Pays Mahafaly (Paris Mus.).

This species is allied to *P. polydorus*, Walk., of S. and E. Africa, from which, apart from other characters, it is at once separated by the largely spinous character of the lateral pronotal margins.

Platypleura seraphina, sp. n.

♀. Head, pronotum, and mesonotum dull ochraceous ; head with two transverse black fasciæ, the first extending through area of ocelli to lateral margin in front of eyes, the other one connected with it, a little more broken and passing through base of front ; pronotum with the lateral and posterior marginal areas stramineous, a central longitudinal fascia connected with an anterior transverse curved line and the incisures black ; mesonotum with two central anterior obconical spots, with a much longer fasciate spot on each side of them crossing the whole of the lateral area, and a triangulate linear spot in front of the cruciform elevation, black ; abdomen above pale castaneous with transverse segmental black fasciæ which are mostly broken on disk ; body beneath and legs dull ochraceous, sternum greyishly tomentose, lateral margins and striations to face, and a fascia between face and eyes piceous or black. Tegmina greyishly subopaque, the veins reddish-ochraceous, with pale fuscous mottlings and shadings, a curved fascia crossing tegmina through radial area, more or less connected with a large faciate spot which more than occupies the whole of seventh apical area, a transverse spot at end of radial area, the transverse veins at bases of apical area 2–5, a double series of spots at apices of longitudinal veins to apical areas, and basal cell, piceous ; wings reddish-ochraceous ; a basal

costal spot, margins to the abdominal areas, and the outer margin—very wide at apex, piceous; marginal membrane pale hyaline. Head including eyes about as wide as base of mesonotum; pronotal lateral margins ampliate and rounded, obsoletely centrally angulate; anterior femora in ♀ practically unarmed.

Long. excl. tegm. ♀ 18 millim. Exp. tegm. 54 millim.

Hab. French Guinea; Rég. de Kouroussa (H. Porbeguin—Paris Mus.).

Allied to *P. severini*, Dist.

Platypleura esa, sp. n.

Head ochraceous, base and anterior margins of front, a spot above base of antennæ, a broad transverse fascia between eyes, and margins of eyes connected with the transverse fascia near area of ocelli, black; pronotum with the posterior margin stramineous, the disk with a central fascia subtriangularly ampliated anteriorly, less ampliated posteriorly, the incisures, and sub-lateral margins (broadly) black; mesonotum black, with the margins of four obconical spots—the two central shortest—ochraceous; cruciform elevation ochraceous; abdomen black; segmental margins castaneous, tympanal flaps stramineous; body beneath ochraceous, sternum greyishly tomentose; anterior margin and central sulcation to face, a fascia between face and eyes, basal areas of opercula, abdominal segmental margins, and under-surface of anterior tibiæ black; tegmina and wings pale hyaline; tegmina, with more than half of basal venation ochraceous, remainder black; basal cell and dividing line between costal membrane and area, black. Head including eyes slightly wider than base of mesonotum; lateral marginal areas of pronotum moderately ampliate, but the margins almost straightly truncate, not angulate; opercula in male broad, reaching the second abdominal segment, their apical margins obliquely convex, their inner margins overlapping; rostrum reaching the posterior coxæ.

Long. excl. tegm. ♂ and ♀ 22–24 millim. Exp. tegm. 65 millim.

Hab. Somaliland; Ouarsangueli and Obok (Paris Mus.).

Yanga bouvieri, sp. n. (Plate XI, fig. 2 *a*, *b*.)

♂. Head, pronotum, and mesonotum greenish or brownish-ochraceous; front of head with anterior marginal lines and a central spot widened and angulated posteriorly, black; vertex with the area of the ocelli, two transverse fasciæ on its lateral area, and a linear longitudinal spot on each side of disk, black; pronotum with the anterior margin, the incisures, and two central lines neither

reaching the anterior margin nor extending to the posterior marginal area, black ; mesonotum with two short obconical spots on anterior margin, a discal triangular spot and a transverse series of four small spots across posterior area, black ; a long, pale castaneous obconical spot on each lateral area which contains two small black spots at its base and one at its apex ; abdomen above black, with a central basal longitudinal ochraceous area, and the segmental margins more or less greyishly pilose ; body beneath and legs greenish-ochraceous, the sternum greyishly tomentose, the opercula palely piceous and greyishly tomentose, their margins dull ochraceous ; tegmina brownish-ochraceous, costal membrane and area more or less greenish, radial area with three pale spots, some obscure paler spots and mottlings in ulnar and apical areas and alternate darker and paler outer marginal spots ; wings pale umber-brown, basal third blackish-castaneous, a streak of the same colour both in and beneath radial area, and much paler castaneous longitudinal rays between the veins on the apical area, extreme outer margin also pale castaneous ; body short, broad, and robust ; head including eyes as wide as base of mesonotum ; lateral margins of pronotum angularly ampliate ; abdomen about as long as space between apex of head and base of cruciform elevation ; costal membrane of tegmina a little wider than costal area ; rostrum extending to posterior coxæ ; opercula somewhat large, their inner apical areas overlapping, their posterior margins slightly convexly rounded, and their disks strongly foveately impressed.

Long. excl. tegm. ♂ 38–40 millim. Exp. tegm. 113 millim.

Hab. MADAGASCAR; Baie d'Antongil (Mocouerys—Paris Mus.).

I have named this species after Prof. A. Bouvier, "Fondateur et Conservateur" of the Paris Museum, from whom I have received much valued entomological assistance at various times.

Yanga grandidieri, sp. n. (Plate XI, fig. 3 *a*, *b*.)

♂. Head, pronotum, and mesonotum green ; head with margins of front, a spot behind anterior angles of vertex, the area of the ocelli and a spot at inner margin of eyes, black ; pronotum with the incisures and two small central spots in front of posterior margin, black ; mesonotum with a spot in front of cruciform elevation and a transverse series of four spots behind it, black ; abdomen piceous, a central longitudinal basal area, the tympanal coverings and posterior segmental margins pale ochraceous ; body beneath and legs pale greenish or inclining to ochraceous ; tegmina green, much suffused with bronzy-green, the costal area and membrane pale green, the first

with a central fuscous spot, outer margin with distinct fuscous spots; wings ochraceous, posterior margin narrowly, and apex broadly, castaneous.

♀. Larger than ♂, abdomen above more castaneous, and with the apical and anal segments cretaceous; tegmina less suffused with bronzy-green, especially on basal area, where there are two distinct fuscous spots in radial area, and about four similar ones beneath them, the apical half is also much more broken up with pale green; wings as in ♂, but sometimes with the apical castaneous area only indicated by two inner spots.

Head, including eyes, about equal in width to base of mesonotum, its length equalling that of pronotum—excluding its posterior margin; opercula in ♂ very strongly concavely sinuate inwardly, the posterior angles overlapping, and thus exposing a circular space of the metasternum; rostrum reaching the posterior coxæ, its apex piceous.

Long. excl. tegm. ♂ 27–32, ♀ 29–30 millim. Exp. tegm. ♂ 70–90, ♀ 90–100 millim.

Hab. Madagascar; Région du Sud-est (Alluaud—Paris Mus.).

Allied to *Y. guttularis*, Sign., from which it is to be differentiated apart from its very distinct coloration by the more produced frontal area of the head and the very broad central longitudinal sulcation to face.

I have dedicated the species to Mon. A. Grandidier, whose name is a household word in the zoological literature of Madagascar.

Umjaba alluaudi, sp. n. (Plate XI, fig. 1 *a*, *b*.)

Head, pronotum, and mesonotum pale virescent; head with the anterior margins of front, two spots on lateral margins of vertex, and the area of the ocelli, black; pronotum with two oblique lines on disk, and eight small spots—three on each lateral area, and two central on posterior area, black; mesonotum with four pale subobsolete obconical spots on anterior area, and a transverse series of four black spots on posterior area; abdomen above piceous, centrally, longitudinally castaneous on basal area; body beneath and legs greenish-ochraceous, ventral segments margined with piceous; tegmina very pale tawny brown, the costal membrane and area virescent; on basal half there are two spots in radial area, and two or three spots in each of the ulnar areas beneath it umber-brown, on apical half there are many umber-brown and greyish mottlings, and a prominent subcostal greyish spot between radial area and apex of wing; wings

pale ochraceous, with an umber-brown submarginal macular fascia. Head including eyes considerably narrower than base of mesonotum ; lateral margins of pronotum slightly and obscurely angulate ; costal membrane of tegmina much narrower than costal area ; opercula with their margins rounded, discally foveate at base, their inner apical angles overlapping ; rostrum reaching posterior coxæ.

Long. excl. tegm. ♂ 36 millim. Exp. tegm. 112 millim.

Hab. MADAGASCAR ; "Vallee d'Ambolo" ; Foret de Sakavalana (Alluaud—Paris Mus.).

Allied to *U. evanescens,* Butl., and although very dissimilar in colour, the markings of the tegmina are very similar in pattern. The two species, apart from colour, can be thus identified :

U. evanescens, ♂.	*U. alluaudi,* ♂.
Greatest width of tegmina nearly equal to half their length. Rostrum passing anterior margins of opercula.	Greatest width of tegmina little more than one-third of their length. Rostrum only reaching anterior margins of opercula.

Pycna natalensis, sp. n. (Plate XI, fig. 4 *a*, *b*.)

Body above ochraceous ; head with two central fasciæ to front which are connected at centre, a transverse spot at anterior angles of vertex, and a fascia between eyes, black ; pronotum with a transverse spot on anterior margin, and two oblique lines from near eyes which converge on disk, black ; mesonotum with four short anterior obconical spots, of which the central two are largest, a central lanceolate spot much ampliated at base, two small spots in front of cruciform elevation, and a submarginal fascia on each lateral area, black ; abdomen greyishly-pilose, segmental margins, and two central lines on first and second segments, black ; body beneath and legs ochraceous, femora streaked with piceous ; central sulcation to face and spot between face and eyes black ; tibiæ castaneous, the tarsi more or less piceous ; tegmina hyaline, the venation castaneous, costal membrane and area ochraceous ; about basal third creamy opaque, with two hyaline spots in radial area, two in base of both third and fourth ulnar areas, and a long hyaline streak in lower ulnar area ; remaining hyaline area of tegmina with scattered fuscous markings ; wings hyaline, venation ochraceous, about basal half ochraceous, opaque, which is partially margined both outwardly and posteriorly with fuscous. Opercula in male broad, transverse, strongly overlapping at their inner margins, their posterior margins

convex ; rostrum reaching the posterior coxæ ; head including eyes much less in width than base of mesonotum ; pronotal margins much ampliated and medially angulate, reaching base of basal cell to tegmina ; costal membrane prominently arched at base and broader than costal area.

Long. excl. tegm. ♂ 30–31 millim. Exp. tegm. 90–92 millim.

Hab. Natal (Stockholm Mus.).

Div. Cicadaria.

Rihana martini, sp. n.

Body above dark chocolate-brown, head, pronotum, and mesonotum sometimes a little paler in hue ; head with the lateral areas of front, a spot at apical angles of vertex, and a transverse fascia between the eyes, black ; pronotum with the anterior margin and two central longitudinal fasciæ connected posteriorly, black ; mesonotum with two anterior central obconical spots, a more indistinct lateral fascia on each side, a central lanceolate spot, its base widened in front of cruciform elevation, which has a spot on each of its anterior angles, black ; abdomen greyishly-tomentose at base ; segmental margins—very broad on second segment, and anterior margins of tympanal coverings, black ; body beneath paler than above ; head and sternum greyishly-tomentose, legs and opercula brownish-ochraceous, abdomen purplish-brown, margins of acetabulæ crimson ; a transverse fascia between eyes, central sulcation to face, and sometimes subapices to femora, black ; tegmina and wings hyaline, extreme bases of both sanguineous ; venation ochraceous or greenish-ochraceous ; tegmina with the transverse veins at bases of second, third, fourth and fifth apical areas more or less infuscate, and a small fuscous spot near apices of longitudinal veins to those areas ; opercula about half the length of abdomen, inwardly overlapping, their lateral margins concavely sinuate, their apical margins rounded ; rostrum just reaching the posterior coxæ ; anterior femora with two strong black spines beneath.

Long. excl. tegm. ♂ and ♀ 34 millim. Exp. tegm. 102 millim.

Hab. Madagascar (Coll. Dist.) ; Région du Sud, Andranomana (Alluaud—Paris Mus.).

Rihana hova, sp. n.

Body above and beneath pale brown, thickly finely greyishly pilose ; head with the lateral striæ to front, area of ocelli anteriorly emitting a transverse linear fascia, lateral margins of vertex, and two

transverse oblique fascia before eyes, black; pronotum with the lateral and posterior margins virescent, the disk with two central—sometimes broken, longitudinal fasciæ united posteriorly, black; mesonotum with two central obconical spots, on each side of which are two small oblong anterior marginal spots, a broad sublateral fascia, and a large spot in front of cruciform elevation anteriorly lanceolately produced, black; abdomen with the segmental margins obscure olivaceous; a central anterior spot to face, ochraceous margined with black, and a black fascia between face and eyes; tegmina and wings hyaline, the venation brownish-ochraceous, tegmina with the transverse veins at bases of second and third apical areas moderately infuscated; length of head more than half the breadth between inner margins of eyes, front moderately prominent; pronotum with the lateral margins angulate a little before the posterior angles; opercula in male longer than broad, centrally overlapping, their lateral margins a little sinuate, their apices broadly rounded and not extending beyond basal abdominal segment; rostrum reaching the posterior coxæ, its apex piceous; anterior femora armed beneath with two long spines and a smaller one near apex.

Long. excl. tegm. ♂ 25 millim. Exp. tegm. 77 millim.

Hab. MADAGASCAR; Ikongo and Morondava (Paris Mus.).

Cicada pulverulenta, sp. n.

Pale brownish-ochraceous, shortly but thickly griseously pilose; head with the lateral areas of front, lateral apical margins of vertex, and a transverse fascia between eyes, piceous; pronotum with two central longitudinal lines—united posteriorly, and the incisures, piceous; mesonotum with four obconical spots of which the two central ones are smallest, a central lanceolate spot, and a small spot in front of each anterior angle of the cruciform elevation, piceous; abdomen above densely griseously pilose, the disks of first and second segments distinctly darker in hue; body beneath pale dull ochraceous; a fascia between eyes and a large spot on face, piceous; opercula greyishly tomentose; basal segmental margins pale castaneous; tegmina and wings pale hyaline; tegmina with the venation and costal membrane ochraceous, both finely spotted with white; transverse veins at base of second, third, and fifth apical areas and small spots near apices of longitudinal veins to apical areas, fuscous; wings with the veins ochraceous; length of head not more than half the width between eyes; head including eyes about as wide as base of mesonotum; opercula in ♂ not passing base of abdomen, sub-

elongate, not overlapping internally, apical margins rounded, lateral margins moderately concavely sinuate ; rostrum reaching posterior coxæ.

Long. excl. tegm. ♂ and ♀, 21 millim. Exp. tegm. 55 millim.

Hab. Madagascar and Seychelles (Paris Mus.).

Div. Dundubiaria.

Cosmopsaltria alticola, sp. n.

♂. Dull ochraceous ; head with the following black markings, viz. a basal angulate spot, margins of pale central apical spot, transverse striations, and basal lateral margins to front and area of the ocelli, an oblique streak on each lateral area of vertex and a basal spot before each eye ; pronotum with two central fasciæ united anteriorly and posteriorly, and the inner lateral margins, black ; mesonotum with the margins of two central obconical spots, a central lanceolate spot, and two small spots in front of basal cruciform elevation, black ; abdomen with the segmental margins black, those to the third, fourth and fifth segments more or less maculate ; body beneath and legs ochraceous ; a fascia between eyes, apex of face, subapical annulations to anterior femora, anterior tibiæ excluding bases, apices of intermediate and posterior tibiæ, and apices of opercula, black, the last posteriorly greyishly tomentose ; tegmina and wings hyaline ; the venation ochraceous, transverse veins at base of second, third and fifth apical areas to tegmina palely infuscate.

Long. excl. tegm. ♂ 40 millim. Exp. tegm. 108 millim.

Hab. Borneo ; Kina Balu (Brit. Mus.).

Allied to *C. montivaga*, Dist., but with the opercula only reaching the fifth abdominal segment; markings also different.

Platylomia juno, sp. n.

Head, pronotum, and mesonotum dull ochraceous; head with a large quadrangular spot on lateral margins of front, the area of the ocelli connected with a transverse angulated spot on each side, and a basal spot near inner margins of eyes, black ; pronotum with two much angulated central fasciæ connected with a curved discal fascia on each side, and a broad sublateral fascia, black; mesonotum with two broken anterior obconical spots, connected with a central fascia much widened posteriorly and occupying the whole anterior area of the cruciform elevation, two sublateral fasciæ and a posterior marginal spot, black ; cruciform elevation centrally ochraceous ;

abdomen black, the anterior areas of the segments above somewhat castaneous ; sternum and coxæ ochraceously tomentose ; transverse striations and longitudinal area of face, a transverse spot between face and eyes, and spots to coxæ black ; a basal spot to face, and the rostrum excluding apex, ochraceous ; legs piceous or black, apices of femora ochraceous ; opercula black with their disks dull ochraceous ; tegmina and wings hyaline, the venation fuscous or brownish-ochraceous, their bases narrowly piceous ; tegmina with the transverse veins at the bases of the second and third apical areas a little infuscated. Face prominently tumid ; rostrum extending a little beyond the posterior coxæ, opercula only reaching the third abdominal segment, situate widely apart and occupying the lateral abdominal areas, sinuate on each side near base, narrowed and a little rounded posteriorly.

Long. excl. tegm. ♂ 40 millim. Exp. tegm. 114 millim.

Hab. Se-Tchouen ; Ta-tsien-lou (R. P. Gros-Jean—Paris Mus.).

Allied to *P. umbrata*, Dist.

Platylomia diana, sp. n.

Closely allied in general appearance and markings to *P. juno*, Dist., but larger, the opercula reaching the sixth abdominal segment, entirely ochraceous excepting their extreme margins and apex, posteriorly globosely convex ; legs ochraceous, longitudinal streaks to femora, bases and apices of the tibiæ, and the tarsi, black.

Long. excl. tegm. ♂ 50 millim. Exp. tegm. 126 millim.

Hab. Se-Tchouen, Ta-tsien-lou (R. P. Gros-Jean—Paris Mus.).

Oncotympana virescens, sp. n.

♂. Body above black ; head with a large spot at base of front, and a small spot on each side of ocelli, ochraceous ; pronotum with a central lunulate ochraceous fascia, the whole of the lateral areas piceous, the posterior margin inwardly pale-greenish ; mesonotum with the lateral margins, the margins of two central obconical spots, and two small spots in front of cruciform elevation, ochraceous ; abdomen with the posterior margins of the second and third abdominal segments, the tympanal coverings, disk beneath, and opercula, pale bright virescent, sternum thickly ochraceously tomentose ; legs black, longitudinally streaked with virescent ; tegmina and wings hyaline, extreme bases of both virescent, the venation fuscous ; tegmina with the transverse veins at the bases of the second,

third, fifth, seventh, and eighth apical areas broadly piceous, and a series of small piceous spots near apices of longitudinal veins to apical areas; opercula in male, broad, centrally overlapping, and reaching base of second abdominal segment; rostrum reaching the posterior coxæ.

Long. excl. tegm. ♂ and ♀ 19–20 millim. Exp. tegm. 107–112 millim.

Hab. Tibet; Tsekoo (Paris Mus.).

Explanation of Plate XI.

Fig. 1. *Umjaba alluaudi.*
2. *Yanga bouvieri.*
3. „ *grandidieri.*
4. *Pycna natalensis.*
5. *Munza revoili.*

May 20th, 1905.

XI. *On the Pupal suspension of* Thais.

By T. A. Chapman, M.D., F.Z.S.

[Read February 1st, 1905.]

Plate XII.

It is now some ten years since I ventured to question the view quoted in Scudder's great work on the American Butterflies as to the suspension of the pupa of *Thais* (Ent. Record, Vol. VI, pp. 125, 126), and somewhat later I obtained (Ent. Record, Vol. VII, pp. 81, 82) tolerably strong evidence that my opinion on the subject was correct. Up till the present time, however, no one has chosen to report actual observation of how the larva and pupa of *Thais* actually manage to make the girth (incidentally proving that it *is* the girth) leave its usual situation and become attached to the nose-hooks. This Spring (1904) I made an effort to supply the deficiency, and obtained a number of larvæ of *Thais polyxena*, Schiff., var. *cassandra*, Mann, from Hyères. I was successful in observing the whole operation by one specimen or another; whether I can successfully describe what I saw is I fear doubtful, but I will make the attempt. I was so interested in the matter, even someway outside the chief point in question, that I also made a successful attempt to see *Papilio machaon* and *Pieris rapæ* (as examples of *Papilionidæ* and *Pieridæ* respectively) make their silken holdfasts for their pupæ. Though there is no novelty about my observations of these, there are one or two points that may bear description again.

The first spinning done by the larva of *Thais* is to form what we must call a cocoon, though it consists merely of three or four, or at most a dozen, rather strong silken cables, sometimes simple, sometimes branching, tying together the objects surrounding the position chosen for suspension. This structure must be correlative with a habit of retiring for pupation into a situation surrounded by not very fixed materials, such probably as dead herbaceous material round shorter stems near the ground-level or below it. Having prepared a carpet of silk of rather more

than its own length, either on a flat surface or by preference on a round one such as a stem, it makes the anal pad. It may be noted here that in *Thais* and the other girthed pupæ observed, when this is completed the larva takes its station with the claspers just in front of it, the little mound of silk forming the pad being unused, and lying immediately behind the claspers and beneath the tip of the anal plate. In suspended pupæ this pad is held by the claspers, whilst the larva awaits pupation.

Before describing the spinning of the girth, it may be as well to explain its position on the larva when it is finished and the larva rests before pupating.

The girth arises well forwards from the carpet of silk, and passes over the back of the first abdominal segment. Each segment of the larva has on either side three tall processes or warts, which with their colours and spines give the larva its special and beautiful aspect. These three warts are a subdorsal one (= I. + II.?), which is the largest, then a somewhat smaller one (= IV. + V.?), which arises below the spiracle though one is inclined before examining it to think it is subdorsal also, *i. e.* above spiracle. The third one is still smaller, and is marginal (= VI.?). In passing over the segment, the girth reaches backwards from its attachment, to behind the marginal process, and passes up in the same line behind the subspiracular one; then it turns forward, and gets in front of the subdorsal process crossing the dorsum therefore rather on the front of the segment, proceeding down the other side of the larva, by, of course, a precisely similar route, to its attachment to the carpet on the other side. In taking this course it makes several bends. First it inclines rather backward from its attachment, has a bend at the marginal process where it turns upwards, and two more bends in passing from behind the subspiracular to the front of the subdorsal process. It is fairly taut, so much so as rather to bend forward the marginal process, against the similar process of the meta-thoracic segment. Nevertheless the curved or angulated route ensures that it shall be of considerable length, longer, that is, than a merely simple transverse course across the back of the larva.

I succeeded in seeing this cable or girth manufactured on several occasions, but that does not seem to help me in describing it in words. As in *Papilionidæ* and *Pieridæ*, it is not spun where we see it when completed, but in a

position that may be described as in front of the larva, the head being thrown back, so that the legs are used as hands, one might say, to hold it up. Not, however, the claws, but the thick bases of the legs are used, the silk not being on the legs proper, but rather in the incision in front of them. This is the position when the spinneret is at the middle of the girth. But as the head goes from one side to another, the relations of parts is much changed, though quite gradually and automatically. It is this that makes it difficult to give a description easy to understand.

The actual line of the girth, at the middle of the movement, when the larva is straight with the head and legs well raised, is behind the marginal process of the 1st abdominal segment, then forwards above the marginal processes of 2nd and 3rd thoracic, and then across the larval venter to the other side in the incision between the first and second pair of legs. I have said the head is well raised, and so it is, by the Sphinx attitude of the first segments, but it is strongly bent forwards, so that the tip of the spinneret reaches very closely to the position of the girth in the incision behind the first pair of legs. I say very nearly, for the girth when completed consists of a number of quite separate threads, showing that each thread is *not* spun along, and glued to those that preceded it, and that therefore the extremity of the spinneret does not actually reach and touch the previously spun threads, which lie deeper in the incision between the segments.

As the larva moves its head from side to side in adding each thread, the position of the girth differs from this central position by being stretched along one side and all but relieved from the other; when the head is round to the left and the left end of the thread is being fixed, the thoracic and first two abdominal segments have their right sides stretched so as to form the margin of nearly a circle, whilst their left sides are so approximated as to be close together at the centre of the circle. In this attitude the line occupied by the girth above the marginal tubercles on the stretched side of the larva is raised above the surface on which the larva rests, and is on what for the moment is rather the upper-side of the larva, though it would be rather the under-side if the larva were in a natural resting attitude, since, as I have above called attention to, the larval warts are, and look, higher up on the larva than their real anatomical positions would indicate.

The following notes made whilst actually watching the larva may help to explain the spinning of the girth, though they have some incoherence from the circumstances of their production.

Cassandra, when building its loop, has it quite ventral, it passes round above the marginal wart of 2nd and 3rd thoracic and 1st abdominal and between the 1st and 2nd pairs of legs. There is, however, only one phase in this process to which this applies, viz. when a thread of silk is being added to the loop at exactly its highest point. When the spinneret is against either side of the loop or working at the point of attachment, the loop is free from all contact with that side of the larva, or just touches the marginal wart of 1st abdominal, whilst it is fully stretched on the other side, over the 2nd thoracic leg, the three warts (2nd, 3rd thoracic, 1st abdominal), and touches the ventral prominence of 1st abdominal. The attitude of the larva being that of a curve or twist that brings these parts directly away from the twig of attachment, whilst those that the loop is free from are crowded together towards the twig, the three warts having their apices close together, and so that on the curvature relaxing they expand again into that side of the loop and hold it whilst the other side contracts and frees itself from the loop in its turn.

The larva moves very leisurely, and with some to and fro movement, so that one traverse of the loop takes about three minutes and the movements of fastening the end of each thread to the twig about one minute; but between each complete traverse usually at least one partial journey is taken, *i. e.* from the twig for about one-third of its length and then back again, and along this piece especially towards the end of the process a good deal of local spinning is done which covers this thicker portion of the loop with an outside binding. When the loop is finished, the central third consists of a number of threads more or less separate, or at least apparently separate, straight, parallel and uncomplicated. The end portions are thicker, and bound together as one strong strand.

As the larva moves its head from side to side, the loop slips to and fro, or rather perhaps the larva slips to and fro on it, the loop always taking the position described on the convex side of the larva, and lifting out of it on the concave, as the warts and legs are contracted together into

one eminence. The head and prothorax are stretched out when the attachment of the loop is being worked at, the first pair of legs being one on each side of the strand; when the centre of the loop is under the spinneret the thorax is bent back from the twig, but the head is bent down to bring the spinneret against the loop in front of the 2nd legs, and the 1st pair of legs become practically invisible. In two specimens watched the whole process took about an hour and a half, in a room at about 64°. One wondered all the time how the loop when finished was to get back to its place. This however is managed very simply and very quickly. After finishing, as it had appeared to finish several times before, one of the lappings of the side of the loop with binding threads, instead of sliding slowly round and bending the head down slowly as it went, to the position it takes when at the central point, it gave it this position at once, *i. e.* before moving round, so that the head went under the loop somewhat to one side, and as it then gradually assumed the median position, the thread lay across the middle of the front of the head. At the same time, however, as it assumed the median position, it bent back the head and curved the thoracic segments backwards, so as to bring close together the back of the head and the dorsal thoracic humps. Then the thread became slack over the head, and slipped back into its place. In one instance, the thread caught, on the side on which the manœuvre was made, the tops of the subspiracular warts of the meso- and meta-thorax, bending them back, the larva rested here a little, probably from some inadvertent movement of mine that alarmed it, and then by a simple turning and stretching movement the loop fell into its place. One asks, Why does the loop always fall to this identical spot, how does the larva manage to make the necessary movement so exactly? This question is justifiable as an expression of admiration that the larva should always make precisely the same movement, but is foolish in not seeing that the same movement will always produce the same result. In fact a little, but very little, latitude is possible, as one could see that the result would be the same had the movement been a little more or less ample, etc. Nevertheless, the length of the loop and the place from which it starts must be very exactly related to the length, thickness, and movements of each larva.

Another point may be noted, whilst the larva is at work

on the loop, the thoracic segments are rather contracted and the abdominal somewhat full, and when first the loop falls into place, it runs more directly backwards than it does later; the head of the larva being rather in front of the points of attachment of the loop. But gradually the abdominal segments shrink, the thoracic enlarge and bend forwards, the whole larva thickens and shortens so that the loop has the position described in my first note. The amount of spinning for the anal hold varies a good deal, but in two specimens in which it appears to be well elaborated, it stands up as a somewhat flocculent little mass, and the prolegs take hold not of this, but a little way in front of it, suggesting that the pupa shall have a freer access to it than if the prolegs held it

My special object being to see how the girth, now of course clearly seen and proved to be a girth, as in other *Papilionidæ*, got moved to the position and function of a nose-cable, I watched carefully for the moult to pupa, to see how this occurred. My notes on this throw no light on the critical question, but may be worth giving on their own merits.

A larva that was very close to the change was watched on—

May 26, 9 a.m. No very definite change noticeable. 10 a.m. Some movements observable and a slight change of colour. 10.30 a.m. All the red has gone from the warts, except those of 8 and 9 abdominal. The others are shrivelled and show no colour, except their black points, the rest of the larva is slaty-grey, quite different to what it was an hour or two ago. No trachea drawn out yet, 3rd thoracic and 1st and 2nd abdominal are very narrow and shrunk. 2nd thoracic large. A good many little wrinklings of empty skin are visible round warts as well as elsewhere on segments. Girth hangs heavily on marginal wart of 3, pressing it forwards, that of 1st abdominal seems to have slipped behind it on one side, collapsed against that of 3rd thoracic on the other. Wart of 9 still full and red, the red would almost seem to depend on the contained fluid, as it disappears with the shrinking and collapse of the warts, which has just occurred. The fluid which filled them must have been absorbed or evaporated very rapidly. Disturbed the larva by placing it in a better position for observation. 10.40. A few slight movements. 4th, 5th and 6th abdominal seem large as also 7th and 8th; 3rd

about normal, intermediate between these and the shrunk 1st and 2nd.

10.45. A few more movements, the changes of dimensions of segments have placed the mouth parts and the legs below the girth. They were not very definitely above or below it before, but rather unrelated to it, but a strictly lateral view made it cross over 2nd pair of legs.

11.35. Colour all but gone from warts of 9th abdominal and claspers are almost collapsed, no other very obvious change. Th. 64° Fahr. 11.50. Some movement occurring. The large size of abdominal 4th, 5th, 6th and 7th very conspicuous, the incisions being much expanded. The appearance is as though the girth was holding up the skin on 1st and 2nd abdominal and meta-thorax, but the contents had gravitated back and distended these lower segments. In this specimen the silk for the tail grip is a little tag, a little loose and flocculent, shaped like a short blunt thorn, of which the apex is at present opposite the middle of the dorsal surface of 10th, the prolegs holding the stem to which the larva is attached some 2·5 mm. above it.

12.30 p.m. Length of different portions of larva: Head and 1st and 2nd thoracic = 3 mm., but these are curved and are much more along dorsum. 3rd thoracic, 1st abdominal = 2 mm., *i. e.* 1 mm. each. 2nd and 3rd = 3 mm. = 1·5 each. 4th, 5th, 6th = 7 mm., *i. e.* 2·3 mm. each; 7th, nearly as much. 7th, 8th, 9th, 10th = 5 mm.

12.45 p.m. Strong movements of contraction in 2nd, 3rd, 4th abdominal segments, but quiescence elsewhere. No definite vermicular movements.

12.55. Regular vermiform movement from behind forwards, one every five seconds without so far much change in skin.

12.58. Tracheæ drawn out along abdominal segments 2–7, loop drawn back, front segments straight.

1.2 p.m. Split down back in usual way. Skin slips back under loop.

1.5. Skin behind loop. Scrap of broken-off tubercle sticks to it; loop lies in 3rd and 4th abdominal incisions.

1.10. Skin gone. The movements of getting hold by the cremaster move the loop to the thoracic abdominal incisions, where it deeply indents wings during movements

for getting rid of skin. Wings not yet descended fully on to 4th abdominal.

1.15. Various movements apparently for forcing fluid forward and expanding wings, etc.

1.18. The attachment of the loop is just opposite the eyes of the pupa; wings, etc., and head above loop swollen and knobbed, below smooth and tapered.

1.22. Occasional movements, but on the whole resting, wings not quite down. Hangs much like an ordinary *Papilio*, except for apparent strangulation of front.

1.24. Wings to place.

1.35. 1st spiracular hollow (with black spiracle at bottom) sinking, dorsal eminence of meso-thorax and wing angles becoming of more mature form and less like swellings from strangulation, but loop still cuts deeply into wing and across base of hind-wing.

1.50. The wings are much straightened out and the loop cuts into them very little to what it did. Abdominal segments are shortening and closing up, not yet quite so much as in a mature pupa.

1.54. Is hanging with a strong sag (or bend) in abdomen.

2.3. From head to end of 4th abdominal, now very long and abdominal segments diminished. The loop is now hardly buried and is seen to be on top of 3rd thoracic (not in 3rd thoracic to 1st abdominal incision) at about $\frac{1}{5}$ or $\frac{1}{6}$ of its width from front border.

2.15. Straightened itself a little and then fell back again. Meso-thoracic dorsal ridges becoming sharper, anterior end still obviously somewhat soft.

2.25. Straighter,—no deformity of wings can be seen either where loop now crosses, or where it did before, except it seems a little impressed on one ridge of the venation.

2.30. A lateral jerk or two.

3.40. Loop is still a girth, though pupa is apparently mature as to form, and much dark shading has appeared.

5.45. No further change, still slung as a *Papilio*.

In both this and following specimens the girth is quite loose and at liberty to slip in any direction. Moving the pupa by touching the head enough to show the girth to be quite free does not in any way alter its position.

It does not look possible for it to slip forwards, but a twist of the pupa might catch it by the wing-spine and

throw it forward. Something of this sort must occur,—when ?

May 27. This specimen escaped observation but moved the girth to nose-hooks some time between 1.15 and 3 p.m., twenty-four hours after moulting to pupa.

Second Specimen.—May 26, 12.35 p.m. Subspiracular tubercles of 1st, 2nd, 3rd and 4th abdominal are now colourless and collapsed, dorsal and marginal of same region also changing. 3rd and 4th abdominal segments are beginning to enlarge. Incisions 4th to 5th abdominal getting wide; up till half-an-hour ago no change was visible and segments were not of very unequal lengths.

1.16. Only a few anal warts still coloured.

1.35. Only wart of 9th abdominal segment still coloured red.

1.50. Thermometer 74° Fahr. Abdominal segments large and incisions wide, 3rd thoracic and 1st abdominal very small. The higher temperature seems helping this specimen on more rapidly than No. 1.

2 p.m. Abdominal incisions wide, lower end looks like end of pupa with larva skin overlaid and claspers (shrunk) stuck on outside.

2.20. 4th, 5th and 6th abdominal very large, incisions wide ; some stretching, almost vermiform, movements.

2.43. Genuine rhythmical vermiform motion begins and head rises a little.

2.50. Quiet again, the three free incisions (of pupa) very wide; from abdominal 4th to 5th incision to head, 11 mm., to claspers, 9 mm.

2.59. Movement beginning again, in 1st, 2nd and 3rd abdominal segments.

3.5. Regular vermiform movement from end to end.

3.6. Skin accumulated at tail.

3.7. Thoracic skin split, it slips down, the collapsed warts passing under loop.

3.15. Process finished. The getting rid of larval skin is delayed a little by its fluid adhesion to pupa. The cremaster got hold at second try, and skin was shoved off at two twists, after fluid adhesion gave in. Loop fell into abdominal 3rd–4th incision as soon as skin left it, but in twistings for shoving off skin it slipped quickly to back of prothorax. To end of wings 8 mm., wings to cremaster, 12 mm.

3.22. Wings getting rapidly down to place. There are

contracting and expanding (lengthwise) movements of thorax.

3.30. Wings into place. 9 mm. head to end of wings, 11 mm. wings to cremaster = 20 mm.

3.40. Top of wings and meso-thorax, etc., have the appearance of being strangulated above loop, being swollen out and lumpy.

3.45. On lateral view, pupa has very *Papilio*-like outline, say *podalirius*, head thrown back, curvature with ventral projection of wings, etc., very different from the straightness of the mature *Thais* pupa.

4.3. Is now hanging very much sagged and bent.

5.45. Seems nearly mature and has more dark colouring. Head to end of wings 12 mm. Wings to cremaster 9·5.

May 27, 4.50. Was not looking at specimen but at another two inches from it, when a sudden movement attracted my attention to it.

I was in time to see the girth take hold of the nose-spines, and see the pupa complete what appeared to be two revolutions on its axis, but might have been one, or three; the whole taking place in less than a second, perhaps a third of a second, apparently as rapidly as an active pupa rotates his tail.

A very unexpected movement, as the pupa looked so straight and stiff (and it is fairly stiff when one receives it in autumn), and for a pupa with a girth to rotate on its axis seems so unlikely, the way in which the girth is twisted round the nose-hooks led me to expect a rotatory movement, but without any change of orientation. What struck me afterwards as remarkable was how in such a sudden movement the pupa came to rest again exactly facing its attachment. An examination of these two pupæ shows that they made at least two revolutions, as the girth has reached the nose-hook and one further revolution has been made twisting it round once (quite) after it had caught, and the cremastral silk also shows twisting.

I have not made it very clear how the revolution is effected. It is by bending the tail to one side and then twirling it round; when I say to one side, I should in this case say forwards, as the attitude during the movement was that of bending away from the supporting twig.

Another specimen was observed to make a second rotatory movement, on one occasion, some hours after the cable had been moved forwards, but it would seem to be

the rule that rotation is made once only for a fraction of a second, about twenty-four hours after the moult.

The rotation is on an axis, *i.e.* it does not sweep the head round in a circle, maintaining the venter towards the stem of attachment all the time, but presents towards the stem successively one side, the dorsum, the other side, and so on. The rotation is effected by the abdominal segments being bent forwards, *i.e.* virtually making the pupa present a deep curve towards the stem. Then by sweeping round the abdominal segments in a way that is common to many pupæ the hollow of the curve remains towards the stem, but affects successively each aspect of the pupa as it rotates.

The mature pupa a few days later is very stiff and straight, and its possessing such motility twenty-four hours after moulting is somewhat unexpected.

In order to observe the way in which the girth is made by the larva of *Papilio*, I obtained a few larva of *P. machaon*, and kept rather a close watch on them, but four succeeded in suspending themselves, girth and all, without my having surprised them at work. They do it apparently somewhat quickly, and give no clear indication beforehand of when they are likely to do so. With the fifth I was more fortunate, happening to look at it when the making of the girth was under way, indeed more than half-finished; he was working at one end, passing the spinneret too and fro about the attachment of the loop. The loop itself, consisting of a number of quite detached threads, passed between the fore-legs of the larva, forwards, the larva being so bent round that its head and prothorax were directed backwards. Then well above the meso-thoracic leg and rather higher on the meta-thorax, then well above the spiracle of the 1st abdominal, not quite so far above that of the second, and then passed down to its other attachment. The most anterior portion of the larva in this position was the side of the meta-thorax and 1st abdominal segment just below the loop. Then the larva began to add another thread to the loop. The head and front segments are well raised and the loop falls into the incision between the 1st and 2nd pair of legs, the head is pressed down and the spinneret lies between the first two legs and reaches very close to the loop; the larva sweeps the head across from the one end of the loop to the other slowly and by short jerks and stops, as though the silk

had to be drawn out. As it does so, the loop which was stretched over the sides of the four segments (2nd, 3rd thoracic, 1st, 2nd abdominal) on one flank, gradually leaves them and becomes stretched over the same line on the opposite side. Then the process of fastening it and spinning various sinuations of silk over the other place of attachment of the loop is repeated. I saw it do this several times, and then at one end it delayed a little, and came up with the head not above the loop, still less the front-legs, but with the loop across the front of the head at the base of the labrum. When about the middle, it made some movements and I thought it was going to throw the loop backwards into place; this, however, it did not do, but continued to the other side; so far as I could see it spun no thread this time, it then twice repeated the ordinary process of adding a thread, and again repeated the passage with the thread above the labrum. It was now making a good many contortions with the effect that the anterior segments became decidedly diminished in bulk; as soon as it reached the end of the loop with it above the labrum, it put the head with little difficulty under the loop so that the loop was across the vertex, and then making the passage across and raising the mouth end of the head, the loop easily slipped backwards. It was not, however, before some little time spent in twistings and contortions, that looked as if intended to push the loop back, but were really effective in again distending the front part of the larva and diminishing the posterior that the loop fell into its place between the 2nd and 3rd abdominal segments, and the larva rested as quite satisfied.

Though the larva was slow and deliberate in its movements this was all done in a very few minutes; the threads of the girth seem to remain distinct and separate, and do so to much nearer their attachment than in *T. cassandra*, where the spreading of silk over the attachment includes the lapping of the adjacent portion of the loop.

It may be noted that the position of the loop in the larva between the 2nd and 3rd abdominal is constant, as I saw it in all specimens, though I did not see it made. In the pupa it is different, viz. just behind the middle of the meta-thorax.

It sinks into the soft chitin of the newly-moulted pupa which, as it were, flows over it in two places on each side, there is in fact a lappet formed at each of these places,

that passes over the loop and encloses it in a short tunnel. Sometimes it is quite fixed here, at others it can be drawn through these tunnels and removed, if it is first cut. The two places where these lappets are found are on the hind-wing, and on the fore-wing just below the cell some little way basal to vein 2.

It is perhaps erroneous to say that the loop sinks into the soft chitin, at least to say so may produce the false impression that there is something accidental about it; it is, however, a constant arrangement, and the lappets are no doubt structures specially arranged for the purpose.

To test this a larva suspended for pupation was treated by cutting the loop away. It was seen very shortly after pupation, before the pupa had quite assumed its permanent form and was still very soft. The very striking fact appeared now, that across the wings there was a very distinct depression marked by a central linear mark, as if the girth were present and indenting the soft pupa. When the pupa had attained maturity with a firm skin, this appearance had gone, and at first glance there was no evidence of the overlapping chitin that bridges over the girth. A closer look, however, showed the prominence at the base of the under-wing that forms the anterior overlapping margin, with a linear groove just behind it, and on the middle of the fore-wing at the position of the tunnel for the girth is a glazed line, but no definite overlapping. It therefore seems that the pupa is prepared for the girth taking its proper position by a definite channel occurring across the wings whilst the cuticle is still plastic; that the two special places (on fore- and hind-wing) are prepared for its inclusion beneath the surface; that of the hind-wing which is a very strong lappet forms even if the girth is not there; that on the fore-wing, the overlying lappet does not form, unless it has the assistance of the downward growth of the wings, which occurs during the maturing of the pupa just before hardening, and as the lappet is not formed, the walls of the tunnel that would contain the girth are left exposed as a glazed line in this position.

As a subsidiary effect of cutting the girth the pupa did not succeed in fastening the cremaster on the provided anal pad of silk. When at rest for pupation the claspers hold the silk in front of the pad, which stands up unoccupied just behind the pupa, or rather behind the claspers and under the end of the anal plate, and in

moulting the cremaster is thrust back over the skin to reach the pad. The loss of the girth, however, deprives the pupa of the power of preserving a correct alignment, and so the fulcrum provided by the skin held in place by the claspers cannot be efficiently utilized.

The whole process of spinning the girth seems therefore to be identical in *Papilio* and *Thais*.

P.S.—The abortive journeys across the loop, between the spinnings of its separate threads and the final journey in which the loop is thrown back, may be speculated on as showing that the movement for spinning and that for throwing back are variations of one and the same movement, and that the definite distinction between them is not so fixed, but that an intermediate movement may occur, either as not being yet entirely eliminated or by reversion.

The larva of *rapæ* makes the girth in a way that is essentially the same as in *Papilio*, but yet with an amount of variation that renders it actually very different. Essentially the girth is made in front of the larva and between the head and first pair of legs (not between the 1st and 2nd pair of legs, as in *Papilio*), but the raising of the front segments of the larva, which in *Papilio* may be likened to the "Sphinx" attitude, is in *rapæ* carried to an extreme, so that when the larva is adding to the middle point of the girth the head is bent back so that the back of the head touches the dorsum of the abdomen, about the incision between 2nd and 3rd abdominal segments, the ventral face of head and first thoracic segment being directed exactly dorsal, the legs of 2nd and 3rd thoracic, forwards. As the head is carried to either side, these forward segments so rotate that the venter becomes ventral over all segments, but the forward segments instead of being bent dorsally, are bent laterally, and the head is against the side of the 2nd and 3rd abdominal segments. In all these positions the loop seems to be fairly tense. When the head is bent to one side, the girth passes over the middle of the 2nd abdominal segment and the middle of the 1st thoracic, the portion of the larva between these two positions being in front of the loop, the rest behind it. In the median position, there is perhaps a large proportion of the 1st thoracic segment in front of the loop. Indeed the head only might be regarded as behind the loop. It is observable, that during this process the

2nd abdominal segment seems small and contracted, the abdominal segments behind and the thoracic in front seeming relatively swollen.

The completion of the process, when the spinning is finished, is really very different from that in *Papilio*. In *Papilio* the front of the head is put forward under the loop and it is slipped back into its place by a movement very similar to that by which a thread is added to the girth. In *rapæ*, at the end of fixing the last thread at the side, the head is merely drawn forward from under the loop.

The references to the spinning of the loop in *Pieridæ* that I have met with, give the idea that it is spun from the outside across the abdominal segments, the spinneret being carried to and fro across the surface of the segment—a feat that a moment's reflection on the details of such a process will show to be impossible. It is made across the 2nd abdominal segment, but the larva is so bent back that the loop passes at the same time round its neck and the spinning is from the inner- or under-side.

When I say that the spinning from the outside is impossible, it is perhaps going too far, for there is no necessary limit to the amount of bending a larva may do, but when one sees the amount of strain on the full-fed larva of *rapæ* to get the head as far back as it does, it is seen that whatever it might be for some hypothetical larva, it would be impossible for *rapæ* to bend further back till the spinneret touches the abdominal dorsum. Or if we take the actual position when the larva is fastening one end of the loop, if it thence carried the spinneret up the side of the segment towards its dorsum, the combination of lateral bending and longitudinal twist would stop the process before the spinneret reached the dorsum, much less reached the other side.

Explanation of Plate XII.

Suspension of *Thais.*

Three several figures of the larvæ of different individuals suspended for change to pupa to show (which the smallest specimen does most successfully) the position of the "girth" at this stage, and three of pupa, the first with the girth in the *Papilio* position it occupies during the first twenty-four hours after moult, the other two with it in the well-known *Thais* position attached to the nose-horn.

XII. *Notes on New Zealand* Lepidoptera. By E. Meyrick, B.A., F.R.S., F.E.S.

[Read February 1st, 1905.]

For the material of the following notes and descriptions I am again indebted to the kindness and energy of Mr. G. V. Hudson, of Wellington, except where it is otherwise stated. In addition to describing the new species I have made some corrections of synonymy and other notes.

HYDRIOMENIDÆ.

Chloroclystis sandycias, sp. n.

Chloroclystis plinthina, Huds., N. Zeal. Moths, 41, pl. vi, 8, *nec* Meyr.

♂ ♀. 14–16 mm. Head and palpi ochreous-white, seldom mixed with green, palpi $2\frac{2}{3}$. Antennæ white ringed with dark grey, in ♂ ciliated with fascicles (3). Thorax whitish-ochreous sprinkled with blackish. Abdomen ochreous-whitish, more or less tinged with reddish-ochreous towards base and apex, and variably sprinkled or mixed with blackish. Fore-wings somewhat elongate-triangular, costa faintly sinuate, apex obtuse, termen bowed, rather oblique ; ochreous-whitish to white ; basal area more or less tinged with reddish-ochreous and suffusedly striated with blackish irroration, usually extending considerably further on costal area than on dorsal; median band almost always conspicuously pale, sometimes mixed with green, generally striated with dark irroration on costa and dorsum but seldom indistinctly throughout, posterior edge formed by a double pale line prominently angulated in middle, more than usually approximated to termen on lower half ; when a series of blackish neural dots precedes this, it follows the angulation of the line ; a blackish linear discal dot, sometimes indistinct ; terminal area reddish-brown, seldom mixed with green, interrupted by a pale patch opposite angle of median band, subterminal line pale, waved ; an interrupted blackish terminal line : cilia whitish more or less suffused with fuscous-reddish, basal half barred with blackish, apical half less distinctly with grey. Hind-wings with termen sinuate, rounded-prominent below middle ; whitish, towards

dorsum obscurely striated with reddish and blackish irroration; a rather large blackish-grey discal dot; terminal area with indistinct grey lines, sometimes reddish-tinged; cilia as in fore-wings.

Twelve specimens, Wellington. Although very variable, this is a neat and easily recognised species; it is one of the smallest, and the almost constantly conspicuous paler median band is a striking feature; it is perhaps nearest to *C. plinthina*, but in that species the palpi are much longer (especially in the ♀, in which sex they are 4½), the expanse of wing greater (19–20 mm.), termen of fore-wings more oblique, post-median series of black dots gently curved in disc, not angulated.

Xanthorhoe chlorias, Meyr.

Venusia princeps, Huds., Trans. N. Zeal. Inst. 1902, 244, pl. xxx, 1, is a synonym of this.

Xanthorhoe oeculta, Philpott.

Xanthorhoe oeculta, Philpott, Trans. N. Zeal. Inst. 1902, 248, pl. xxxii, 5. A specimen received; it is a good species, apparently allied to *Xanthorhoe mnesichola*.

Xanthorhoe periphæa, sp. n.

♂. 26 mm. Head, thorax, and abdomen fuscous sprinkled with whitish. Fore-wings triangular, termen slightly bowed, oblique; light fuscous, sprinkled with darker fuscous and whitish; two very obscurely darker fasciæ indicating median band, first curved, preceded by several white dots, second irregularly curved outwards on upper ⅔, followed by a series of white dots; some whitish dots indicating subterminal line, edged with obscure darker shades: cilia fuscous-whitish, with two fuscous lines. Hind-wings rather elongate, light fuscous; cilia as in fore-wings.

One specimen; Humboldt Range, Lake Wakatipu, at 4000 ft. An obscure species, apparently nearest to *X. ehionogramma*.

Notoreas synclinalis, Huds.

Notoreas synclinalis, Huds., Trans. N. Zeal. Inst. 1902, 244, pl. xxx, 6.

♂ ♀. 25–26 mm. Head and thorax grey-whitish, more or less mixed with fuscous; thorax with a blackish stripe on each side of back. Fore-wings rather elongate-triangular, costa sinuate, termen bowed, rather strongly oblique; ochreous-brown; a broad grey

streak along costa, in ♀ mixed with whitish, connected at base with a white longitudinal median streak reaching to ⅔ of disc ; two longitudinal black streaks above and below middle, curved upwards posteriorly, not reaching termen, upper interrupted near base and more broadly posteriorly, lower indented above on veins, margined beneath by a white streak curved up round its extremity, indented beneath extremity of upper and continued round it to apex of wing ; a slender dark grey terminal streak, in ♀ mixed with whitish : cilia dark grey, more or less mixed with white, especially in ♀. Hind-wings blackish-grey, with faint pale post-median shade.

Three specimens ; Seaward Moss, Invercargill. Allied to *N. insignis*, but very distinct.

Notoreas mechanitis, Meyr.

Three specimens sent of a well-marked local form occurring on Mt. Holdsworth, Tararua Range, north of Wellington, at 4000 feet, characterized as follows :

25–27 mm. (typical form does not exceed 23 mm.) ; duller, with less yellow intermixture ; specially characterised by the obsolescence of the black lines on under-surface of hind-wings, which are strongly marked in all South Island forms.

Notoreas isoleuca, Meyr. (the locality for which should, I am informed, be Castle Hill, not Wellington), is, as I am now satisfied from further material, only a form of *N. mechanitis*, the chief differences being due to a diminution of the yellow suffusion. The species is however in all its forms always quite distinct from *N. paradelpha*, in which the wings are differently formed, the fore-wings being somewhat more elongate, with the costa straighter, and the hind-wings obviously more elongate in proportion to the fore-wings, the cilia sharply barred, the median band of fore-wings narrower and differently formed, its anterior margin much less curved, and posterior less angulated in middle, and regularly indented above and below middle.

Notoreas ischnocyma, sp. n.

Notoreas isoleuca, Huds., N. Zeal. Moths, 72, pl. viii, 27, *nec* Meyr.

♂. 20 mm. Head and thorax dark fuscous. Fore-wings triangular, costa slightly arched, termen obliquely rounded ; dark fuscous, with some scattered yellow-whitish scales ; subbasal, first, median,

second, and subterminal lines slender, whitish, subbasal straight, first nearly straight, somewhat irregular, median indistinct, curved outwards in disc, second waved throughout, angulated in middle, indented beneath middle, subterminal irregularly waved: cilia white, basal half barred with dark fuscous. Hind-wings with ground colour, median, second, and subterminal lines, and cilia as in fore-wings.

One specimen, Castle Hill. This is easily known from the allied forms by the slender waved second line.

Notoreas omiehlias, Meyr.

♂ ♀. 22–27 mm. In fresh specimens the fore-wings show a bluish-slaty gloss; in Mt. Holdsworth examples the edge of basal patch and margins of median band are marked by slender light dull ochreous fasciæ, but these are hardly perceptible in my other specimens.

Seven specimens, Humboldt Range, and Mt. Holdsworth.

MONOCTENIADÆ.

PARAGYRTIS, gen. n.

Face obliquely prominent. Tongue developed. Antennæ $\frac{2}{3}$, in ♂ bipectinated, towards apex simple. Palpi moderately long, porrected, rough-scaled. Thorax not hairy beneath. Fore-wings: 10 anastomosing with 9 above 7. Hind-wings: 6 and 7 approximated, 8 approximated to cell to beyond middle.

Allied to *Theoxena*.

Paragyrtis inostentata, Walk.

Panagra inostentata, Walk. Cat. Geom. 1012; *Dichromodes griseata*, Huds. Trans. N. Zeal. Inst. 1902, 244, pl. xxx, 5.

♂ ♀. 15–23 mm. Head and thorax white, more or less irrorated with fuscous. Fore-wings rather elongate-triangular, costa straight, termen straight, rather oblique, strongly rounded beneath; ground colour formed by fine transverse rows of dark fuscous scales tipped with white, appearing grey, sometimes broadly suffused with white beneath costa and beyond second line; a black discal spot; second line represented by a sinuate dark fuscous shade from beneath costa near apex to dorsum beyond middle, sometimes broadened on lower portion, more usually faint or wholly obsolete; in one specimen a dark fuscous prætornal suffusion: cilia dark

fuscous, tips white, round tornus lighter. Hind-wings elongate, varying from whitish to grey, towards termen usually darker-suffused ; in the most strongly marked specimen there are suffused darker post-median and prætornal shades as in fore-wings ; cilia grey, extreme tips white.

Seaward Moss, Invercargill ; described from one New Zealand and twelve Australian examples. This species was accidentally omitted from my paper on the Australian species of this family, but it has long been known to me, being in fact one of the commoner Australian species, occurring at Duaringa and Brisbane, Queensland ; Sydney and Blackheath, New South Wales ; Melbourne, Victoria ; Blackwood, South Australia ; Perth and Albany, West Australia ; from September to January. I have not however previously seen it from New Zealand. It is extremely variable in the depth of colouring and intensity of marking.

SELIDOSEMIDÆ.

Selidosema pungata, Feld.

Selidosema pungata, Feld., Reis. Nov., pl. cxxxi, 23 ; *S. fascialata*, Philpott, Trans. N. Zeal. Inst., 1902, 248, pl. xxxii, 7.

♂. 40 mm. Head and thorax brownish-ochreous. Fore-wings somewhat elongate-triangular, costa gently arched, termen bowed, little oblique ; light ochreous-brown, with scattered short fuscous strigulæ marked with a few black scales ; a rather broad dark fuscous median band, edged narrowly anteriorly and more broadly and suffusedly posteriorly with ochreous-whitish, anterior edge slightly curved, posterior rounded-prominent near costa and more broadly below middle, thus concave above middle ; subterminal line waved, ochreous-whitish, edged with dark fuscous suffusion, rather broadly interrupted in middle, posterior marginal suffusion running to termen beneath apex instead of to costa. Hind-wings light ochreous-yellow, towards termen deeper and more ochreous.

One specimen ; according to Mr. Philpott, this species occurs in several localities in Southland in February and March, and the female does not differ from the male except in being somewhat paler. It is very similar to *S. productata*, but constantly distinguished by the peculiar form of the posterior margin of median band of fore-wings. Not knowing of the existence of this species, I formerly attributed Felder's figure to *productata*.

PHYCITIDÆ.

Sporophyla, gen. n.

Face rounded; tongue developed. Antennæ ¾, in ♂ simple, shortly ciliated, basal joint moderate. Labial palpi moderately long, obliquely ascending, second joint much thickened with dense scales, terminal joint short, obtuse. Maxillary palpi rudimentary. Fore-wings: 4 absent, 3 and 5 connate, 8 and 9 stalked. Hind-wings: 2 almost from angle of cell, 4 absent, 3 and 5 stalked, 6 and 7 connate, 8 closely approximated to cell and anterior portion of 7.

Allied to *Crocydopora*, but distinguishable by the simple antennæ of the male; the labial palpi are also shorter and stouter.

Sporophyla œnospora, Meyr.

Crocydopora œnospora, Meyr., Trans. Ent. Soc. Lond., 1897, 388.

Having now received additional specimens, including the male, which was previously unknown, I am enabled to characterize the genus as above, and also to add the following particulars to my specific description:

♂ ♀. 15–17 mm. Head and thorax dark grey mixed or densely irrorated with white, sometimes mixed with ferruginous. Fore-wings as described, but more usually without ferruginous admixture, varying considerably in the preponderance of white or blackish scales, in one specimen densely irrorated with white throughout so as to obscure the markings. Hind-wings varying from grey to dark fuscous, usually darker terminally.

Three additional specimens, Ida Valley, Otago, taken by Mr. J. H. Lewis. This species is evidently very variable.

CRAMBIDÆ.

Orocrambus machæristes, sp. n.

♂ ♀. 21–24 mm. Head and thorax dark brown mixed with blackish, centre of crown and of thorax anteriorly and in ♀ face whitish. Palpi blackish-fuscous, whitish internally. Antennæ dark fuscous. Abdomen dark fuscous, somewhat whitish-sprinkled. Fore-wings elongate, moderately dilated, costa hardly arched, apex obtuse, termen rather oblique, straight, rounded beneath; brown, more or less mixed with dark grey and grey-whitish (more strongly in ♀);

an ochreous-white median longitudinal streak from base to $\frac{3}{5}$, dilated and obliquely truncate posteriorly, edged beneath by a thick blackish streak which curves up round posterior extremity, where it is interrupted by interneural lines of ground colour, and continued as a series of diminishing spots to near costa; a black subdorsal streak from base to $\frac{1}{3}$; a curved series of blackish marks on veins from $\frac{4}{5}$ of costa to tornus: cilia grey, with darker basal shade, tips ochreous-whitish. Hind-wings dark grey, becoming blackish-grey towards termen; cilia as in fore-wings.

Two specimens, Mount Earnslaw (5300 feet). A striking and distinct species.

Crambus æthonellus, Meyr.

The female differs considerably from the male, and may be described as follows:

♀. 20 mm. Fore-wings brassy-bronze, suffused with dark fuscous in disc and on veins posteriorly; a narrow white sub-costal streak from base to near apex, sometimes interrupted obliquely beyond middle, broader and more suffused posteriorly, connected at base with a moderate straight white median streak from base to termen; a white dorsal streak from near base to tornus, dilated posteriorly: cilia white, mixed with fuscous at apex and below middle of termen. Hind-wings rather dark fuscous, darker posteriorly; cilia whitish-ochreous, with a fuscous line.

I took both sexes in company at Invercargill, and have since received a female taken in the same district by Mr. Philpott.

Crambus heteraulus, sp. n.

♂. 35 mm. Head white, behind eyes and in centre of face brownish-ochreous. Palpi nearly 4, bronzy-ochreous, white above and at base beneath. Antennæ dark fuscous. Thorax bronzy-ochreous, with broad white dorsal stripe. Abdomen whitish-ochreous. Fore-wings elongate, moderately dilated, costa moderately arched, apex nearly rectangular, termen obliquely rounded; brownish-ochreous, with strong brassy reflections; a rather narrow white median longitudinal streak from base to beyond $\frac{2}{3}$, thence continued as three undefined white interneural lines to termen, edged with some darker scales posteriorly above, and towards middle beneath; dorsum narrowly white towards base; two elongate wedge-shaped white interneural streaks resting on termen beneath apex, uppermost longer; cilia white. Hind-wings fuscous-whitish; cilia white,

One specimen, Humboldt Range (3600 feet). Nearest to *C. crenæus*, from which it differs by the fore-wings being broader, with more arched costa, the median white streak incomplete posteriorly, and the white interneural streaks between this and apex; from all other nearly allied species it differs by the absence of any white costal or sub-costal streak.

Crambus sophistes, sp. n.

♂. 17 mm. Head, palpi, and thorax fuscous, suffusedly mixed with whitish; palpi 5. Antennæ dark grey. Abdomen whitish, basal half brassy. Fore-wings very elongate, narrow, gradually dilated, costa gently arched, apex somewhat acute, termen rounded, rather strongly oblique; fuscous, irregularly irrorated with grey-whitish; a short suffused dark fuscous mark along dorsum towards base; a slender white streak, edged with scattered dark fuscous scales, along fold from base to middle, thence acutely angulated inwards to near dorsum, this portion edged posteriorly with some dark fuscous suffusion; two dark fuscous dots longitudinally placed in disc about $\frac{2}{3}$; two sub-terminal series of short blackish dashes on veins, and a third less complete on termen: cilia whitish, with two interrupted fuscous lines. Hind-wings fuscous-whitish; cilia ochreous-white.

One specimen, Ida Valley, Dunedin, taken by Mr. J. H. Lewis. The species is intermediate between *C. cyclopicus* and *harpophorus*, but cannot be confused with either.

Argyria strophæa, sp. n.

♂ ♀. 15–18 mm. Head and thorax ochreous-whitish, partially yellowish-tinged, and sprinkled with dark grey. Palpi 4, grey, darker-sprinkled, whitish above and towards base beneath. Antennæ ochreous-whitish, obscurely ringed with dark fuscous. Abdomen ochreous-whitish irrorated with dark grey. Fore-wings elongate-triangular, costa gently arched, apex obtuse, termen slightly rounded, oblique, faintly waved; pale brassy-ochreous, suffusedly mixed with white, and irrorated with dark grey; subbasal line white, edged anteriorly with dark fuscous, angulated near costa, obsolete towards dorsum; first and second lines white, more or less edged with dark fuscous, first obtusely angulated above middle, second sinuate inwards towards dorsum, preceded on costa by a small dark fuscous spot; a small roundish dark fuscous spot in disc before middle; a narrow white transverse mark in disc beyond middle; a terminal series of dark fuscous lunulate marks: cilia whitish, with

a fuscous subapical line, basal half barred with fuscous. Hind-wings grey, darker posteriorly; cilia as in fore-wings.

Five specimens, Wellington. It is extremely distinct, bearing very little resemblance to the other New Zealand species, *A. pentadactyla*, yet probably more allied to it than to any other known to me.

Tauroscopa trapezitis, sp. n.

♂. 22 mm. Head and thorax blackish-fuscous mixed with white, orbits and cheeks naked, orange. Palpi dark fuscous, white on upper longitudinal half and at base beneath. Antennæ blackish, towards base whitish-sprinkled. Abdomen bronzy-fuscous sprinkled with white. Fore-wings elongate-triangular, costa faintly sinuate, apex rounded, termen rather obliquely rounded; grey, partially slightly ochreous-tinged, densely and suffusedly mixed with whitish; markings blackish, somewhat irregular-edged; a streak along basal third of dorsum, and a streak from base of costa equal and parallel to this; two small costal spots before and one beyond middle; an oblique narrow-trapezoidal spot in disc before middle, its posterior edge formed by whitish first line, which is very acutely angulated below middle; a reniform discal spot slightly beyond middle; second line whitish, obtusely angulated in middle and indented beneath costa, edged with black anteriorly and by an oblique black spot on costa posteriorly; a terminal series of small black spots: cilia grey, with dark grey basal shade, tips white. Hind-wings rather dark grey; cilia grey, mixed with white towards tips.

One specimen, Mount Earnslaw, at 5300 ft. This, the second discovered species of the endemic genus *Tauroscopa*, bears a general resemblance to *T. gorgopis*, but is very distinct, especially by the peculiarly formed first line; whilst the singular naked orange cheeks and orbits are quite a unique feature, of which there is no trace in the other species.

Diptychophora microdora, sp. n.

♂ ♀. 10–12 mm. Head, palpi, antennæ, thorax, and abdomen dark fuscous; palpi mixed with yellowish towards base. Fore-wings triangular, costa gently arched, apex obtuse, termen bisinuate, oblique, rounded beneath; dark fuscous, bronzy-tinged; first and second lines dark, angulated, edged on costa with yellow striguläe, first edged on dorsal half anteriorly by two confluent yellow spots and posteriorly by a yellow line, second edged posteriorly towards

dorsum by a wedge-shaped yellow mark ; a yellow costal strigula just before apex, terminated by a white dot ; cilia dark grey, with an irregular white basal line round apex and upper part of termen (imperfect). Hind-wings and cilia dark fuscous.

I took a specimen on Mount Arthur at 3000 feet in January, and have received a second from Mr. Hudson, but neither is in very good condition. The species is nearly allied to *pyrsophanes*, but much smaller, darker, and with more developed yellow markings.

PYRAUSTIDÆ.

Scoparia melituryga, sp. n.

♂ ♀. 17–19 mm. Head and thorax ochreous-white irrorated with dark fuscous. Palpi 3, dark fuscous, whitish-mixed, white towards base beneath. Antennæ dark fuscous, ciliations in ♂ ½. Abdomen pale grey, more or less suffused with ochreous-whitish. Fore-wings elongate-triangular, costa gently arched, apex obtuse, termen slightly sinuate, rather oblique, rounded beneath ; ochreous-whitish, more or less suffused with pale ochreous-yellowish in disc, sprinkled with dark fuscous ; first line ochreous-white, edged posteriorly with dark fuscous suffusion, slightly curved, indented in middle ; orbicular and claviform usually quite undefined or represented only by some dark fuscous suffusion, seldom orbicular centred with an ochreous-whitish dot ; discal spot 8-shaped, ochreous-whitish or whitish-ochreous, more or less outlined finely with dark fuscous ; second line ochreous-white, edged anteriorly with dark fuscous, moderately curved outwards from ¼ to ¾, sharply indented at ¼ ; terminal area irrorated with dark fuscous, subterminal line thick, suffused, ochreous-whitish, touching second line in middle, sometimes slenderly interrupted above this ; an interrupted ochreous-white terminal line : cilia whitish, with dark grey interrupted anterior and light grey posterior line. Hind-wings without long hairs in disc ; pale whitish-grey, suffused with grey posteriorly ; cilia whitish, with grey subbasal shade.

Six specimens, Auckland and Wellington, taken by myself in December and January ; I have also received the species from Mr. Hudson. Until lately I had mistaken this for a form of *S. philerya*, but am now satisfied of its distinctness ; it is a neater and smoother-looking insect, always recognizable by the well-marked yellowish tinge ; moreover in *S. philerya* the orbicular is normally white

edged with black, and the subterminal line is more broadly interrupted.

Scoparia thyridias, sp. n.

♂. 18 mm. Head fuscous. Palpi 2½, fuscous, white towards base beneath. Antennæ dark fuscous, ciliations ½. Thorax brownish, mixed with whitish and dark fuscous. Abdomen whitish-fuscous. Fore-wings very elongate-triangular, costa gently arched, apex rounded-obtuse, termen rather oblique, rounded; brownish, densely and suffusedly irrorated with dark fuscous; first line white, nearly straight, rather oblique, irregular-edged, becoming double towards dorsum; an oblong pellucid patch in middle of disc, preceded and followed by blotches of orange suffusion, anterior extended downwards along first line; second line slender, waved, white, curved outwards from ¼ to ¾, forming a spot on dorsum; subterminal line very undefined, whitish, broadly interrupted above middle: cilia whitish-fuscous, with two darker shades. Hind-wings without hairs in disc; light grey, darker terminally; cilia as in fore-wings.

One specimen, locality not specified but probably Wellington. This is distinguished from all other New Zealand species by the naked discal patch (possibly not developed in ♀); a similar structure is found in certain Hawaiian species, but I think it improbable that they are nearly allied specifically, and regard the character as having been developed independently in each case. *S. thyridias* belongs apparently to the neighbourhood of *S. philerga*.

Scoparia dochmia, sp. n.

♂. 20 mm. Head brownish-ochreous, somewhat whitish-sprinkled. Palpi 3, dark fuscous, white towards base beneath. Antennæ dark fuscous, ciliations ½. Thorax fuscous, whitish-sprinkled. Abdomen pale ochreous-grey, whitish-mixed. Fore-wings elongate-triangular, costa gently arched, apex obtuse, termen faintly sinuate, rather oblique, rounded beneath; light brownish irrorated with darker, veins and margins suffusedly irrorated with blackish, median area irrorated with white; first and second lines well-marked, white, interiorly blackish-edged, first somewhat curved, rather oblique, sinuate in middle and rather abruptly rounded-prominent below this, preceded in middle by a spot of white and blackish irroration; second parallel to termen, slightly curved from ¼ to ¾; orbicular and claviform forming undefined spots of blackish suffusion resting on first line; discal spot X-shaped, blackish, ill-defined; subterminal line indicated by whitish irroration, entire, approximated to termen

and not touching second line : cilia whitish-fuscous, with two rather dark fuscous shades. Hind-wings without long hairs in disc ; pale whitish-fuscous, with a slight brassy tinge ; a grey discal spot ; an undefined grey postmedian line ; termen suffused with grey ; cilia whitish, with fuscous subbasal shade.

One specimen, Lake Wakatipu, at 1300 feet. Although an ordinary-looking insect, without striking characters, this species does not in fact at all nearly approach any other ; possibly it has most resemblance to the Australian *S. eremitis*.

Scoparia triclera, sp. n.

♀. 12 mm. Head, thorax, and abdomen dark grey sprinkled with whitish. Palpi $2\frac{3}{4}$, dark fuscous, white towards base beneath. Antennæ dark fuscous. Forewings elongate-triangular, costa posteriorly gently arched, apex obtuse, termen rather oblique, faintly sinuate, rounded beneath ; blackish-fuscous mixed with whitish ; a small pale ochreous elongated subbasal spot in middle ; a broad ochreous-white postmedian band parallel to termen, somewhat narrowed towards costa, mixed with ochreous in disc ; subterminal line undefined, whitish : cilia dark fuscous, somewhat whitish-mixed. Hind-wings without long hairs in disc ; dark fuscous ; cilia fuscous, base pale.

One specimen, Wellington. In size, shape and general markings so like *S. chlamydota* that I should have thought it one sex of that species, of which however I have both sexes, not differing at all from one another ; I am therefore obliged to regard it as distinct. It is easily separated by the dark fuscous terminal area of fore-wings, and the dark fuscous hind-wings.

Scoparia phalerias, sp. n.

♀. 23 mm. Head ochreous, sprinkled with dark fuscous. Palpi $2\frac{1}{2}$, ochreous, mixed with dark fuscous, white towards base beneath. Antennæ ochreous spotted with dark fuscous. Thorax brown mixed with dark fuscous, edged laterally and posteriorly with ochreous-white. Abdomen light greyish-ochreous. Fore-wings elongate, gradually dilated, costa slightly arched posteriorly, apex obtuse, termen rather oblique, faintly sinuate, rounded beneath ; dark fuscous, with fine scattered whitish scales ; a pale ochreous patch, mixed with ochreous-brown, extending along costa from $\frac{1}{3}$ to $\frac{5}{6}$, and reaching nearly half across wing ; a small round pale ochreous spot

beneath this before middle, and a narrow elongate one beyond middle: cilia ochreous-white. Hind-wings without hairs in disc; pale grey, darker towards apex; cilia whitish.

One specimen, Wellington, in April. Not at all like any other, but perhaps allied to *S. submarginalis*.

Scoparia sideraspis, sp. n.

♂ ♀. 25–28 mm. Head dark grey mixed with whitish. Palpi 3, blackish mixed with white, towards base white beneath. Antennæ dark fuscous, in ♂ pubescent-ciliated on whole surface. Thorax shining bluish-bronze. Abdomen bronzy-fuscous, in ♀ suffused with yellow-ochreous on sides and posteriorly. Fore-wings elongate, moderate, suboblong, in ♂ more dilated posteriorly; shining slaty-bluish fuscous; a faint darker undefined discal spot: cilia fuscous. Hind-wings with long hairs in disc; fuscous, darker posteriorly, in ♀ more or less tinged or suffused with ochreous-yellowish anteriorly; cilia whitish-yellowish, with two fuscous lines. Under-surface, especially of hind-wings, more or less wholly suffused with ochreous-yellow.

Three specimens, Mount Earnslaw (5300 feet) and Humboldt Range. The slaty-bluish colouring recalls *S. cataxesta*, to which however the species is not really allied, but rather to the neighbourhood of *S. nomentis*, though very distinct; the ochreous-yellow suffusion of the under-surface is a peculiar characteristic.

PTEROPHORIDÆ.

Platyptilia epotis, sp. n.

♀. 25 mm. Head white. Palpi $2\frac{1}{2}$, greyish-ochreous sprinkled with dark fuscous, white above. Antennæ grey. Thorax whitish suffusedly sprinkled with brownish-ochreous, patagia becoming clear white posteriorly. Abdomen white, partially suffused with pale brownish-ochreous except towards base. Legs white, anterior femora and tibiæ fuscous. Fore-wings with apex pointed, subfalcate, termen rather deeply concave; pale brownish-ochreous densely irrorated with white, broadly suffused with white towards costa and dorsum on posterior half; basal $\frac{1}{4}$ of costa irrorated with dark fuscous, thence a narrow dark fuscous costal streak reaching to $\frac{3}{4}$; a dot of two or three dark fuscous scales in disc at $\frac{2}{3}$; a short transverse blackish-fuscous mark before cleft; a strong oblique blackish streak from apex to anterior half of lower margin of first segment, where it is

broadest ; an undefined blackish-fuscous longitudinal dash in centre of basal half of second segment : cilia whitish, with a dark fuscous spot above apex, an interrupted blackish basal line on central third of termen, and two or three blackish scales on dorsum at $\frac{2}{3}$. Hind-wings pale fuscous, second segment whitish-tinged ; cilia whitish-fuscous ; two or three fine blackish hair scales in dorsal cilia of third segment beyond middle.

One specimen, Humboldt Range, at 3600 feet. The stalk of veins 8 and 9 of fore-wings is very short. The species resembles generally *Stenoptilia leucoxesta* and *S. charadrias* (probably with real genetic affinity), but is distinct from everything by the well-defined blackish subapical bar.

EPIBLEMIDÆ.

Noteraula sideritis, sp. n.

♂. 15 mm. Head and thorax brownish-ochreous. Palpi moderately long ($2\frac{3}{4}$), ochreous-brown. Antennæ whitish-ochreous, with dark fuscous serrations. Abdomen grey, darker posteriorly, anal tuft whitish-ochreous. Fore-wings elongate, somewhat dilated posteriorly, costa moderately arched, apex obtuse, termen slightly sinuate, rather oblique, rounded beneath ; whitish-ochreous finely strigulated with dark fuscous, mixed in disc and towards apex wholly suffused with ferruginous-ochreous ; two curved posterior oblique purplish-leaden-metallic striæ from costa at $\frac{2}{3}$ and $\frac{4}{5}$, terminating before and beyond tornus ; a series of undefined blackish marks between these, starting from an oblique leaden-metallic costal streak ; a short direct leaden-metallic costal streak before apex : cilia grey, basal third with a blackish-grey line broadly interrupted with brownish-ochreous, at tornus whitish-ochreous. Hind-wings grey, terminal edge whitish ; cilia light grey, with darker basal line.

One specimen, Wellington (?). The discovery of a second species of this genus is interesting ; the palpi are much shorter and the termen of fore-wings much less oblique than in *N. straminea*.

Strepsicrates dolopæa, sp. n.

♂. 13 mm. Head, palpi, and thorax pale greyish-ochreous irrorated with whitish. Antennæ grey, suffused with whitish above, notch at about $\frac{1}{3}$ from basal joint. Abdomen pale greyish-ochreous. Fore-wings elongate, narrow, costa moderately arched, apex round-pointed, termen sinuate, oblique, rounded beneath, costal fold reach-

ing $\frac{2}{5}$; pale greyish-ochreous, irrorated with whitish and strigulated with fuscous, posteriorly more ochreous; an undefined patch of fuscous suffusion extending along costa from $\frac{2}{5}$ to $\frac{4}{5}$; margins of ocellus, and an angulated stria beyond it leaden-metallic: cilia pale grey irrorated with whitish. Hind-wings with 3 and 4 coincident; whitish-grey; cilia grey-whitish, with faint grey subbasal shade.

One specimen, Wellington. Structurally similar to *S. zopherana*, but much paler, and without any of the dark markings of that species.

TORTRICIDÆ.

Dipterina hemiclista, sp. n.

♂. 15 mm. Head, palpi, and thorax grey mixed with dark fuscous, palpi short, $1\frac{1}{2}$. Fore-wings elongate, considerably dilated posteriorly, costa gently arched, apex obtuse, termen obliquely rounded; rather dark slaty-grey, with irregular angulated dark fuscous striæ, tending to break up into strigulæ; edge of basal patch dark fuscous, right-angled in middle; an oblique dark fuscous blotch on costa before middle, another at $\frac{2}{3}$, and a third apical: cilia grey mixed with dark fuscous. Hind-wings fuscous, darker posteriorly.

One specimen, Wellington. Not like any of the other New Zealand species (which also differ much among themselves), but with considerable resemblance to an undescribed Tasmanian species.

Eurythecta zelæa, sp. n.

♂. 10–11 mm. Head ochreous, face and a central longitudinal streak on crown suffused with white. Palpi 2, white, externally suffused with ochreous. Antennæ dark grey. Thorax fuscous mixed with ochreous and whitish. Abdomen fuscous. Fore-wings lanceolate, round-pointed, obviously more elongate and narrower than in *E. robusta*; fuscous, more or less mixed irregularly with pale yellowish-ochreous and white; costa suffused with white, and marked with a quadrate dark fuscous spot before middle, and three smaller posterior spots; a dark fuscous dorsal spot before middle, another on tornus, and several more or less defined dots on termen: cilia fuscous, basal third mixed with whitish, tips pale. Hind-wings rather dark fuscous, darker posteriorly; cilia fuscous, paler towards tips.

Two specimens, Ida valley, Otago, taken by Mr. J. H. Lewis. This is closely allied to *E. robusta*, but differs in

the absence of the two dark fasciæ, which though often interrupted are always present and well-marked as fasciæ in *E. robusta*, whereas in *E. zelæa* they are represented only by small costal and dorsal spots; and also structurally in the considerably narrower and more elongate fore-wings. *E. robusta* may be extinct; I believe it has not been seen for very many years, though formerly locally abundant.

Ascerodes, gen. n.

Palpi moderately long, porrected, triangularly scaled with long rough projecting hairs. Antennæ in ♂ biciliated with fascicles of long cilia. Thorax without crest. Forewings in ♂ without costal fold; 7 and 8 separate. Hind-wings without pecten of hairs on lower margin of cell; 3 and 4 approximated at base, 5 somewhat approximated to 4, 6 and 7 approximated at base.

Apparently most allied to *Harmologa*, from which it differs by the absence of the costal fold; separable from *Proselena* and *Prothelymna* by veins 6 and 7 of hind-wings not being stalked.

Ascerodes prochlora, sp. n.

♂. 18 mm. Head, palpi, and thorax dark fuscous mixed with ferruginous-orange, palpi 3. Antennæ blackish spotted with white, ciliations 3. Abdomen dark grey, with whitish lateral streaks. Fore-wings elongate, suboblong, costa moderately arched towards base and apex, apex rounded, termen somewhat rounded, rather oblique; dark grey, densely overlaid with ferruginous-brown; costa broadly and dorsum narrowly suffused with pale yellowish-ochreous: cilia ochreous-whitish, basal half suffused with dark grey. Hind-wings dark grey, more blackish-grey posteriorly; cilia whitish, basal half greyish-tinged, with blackish-grey basal line.

One specimen, Humboldt range, at 4000 feet.

Tortrix indigestana, Meyr.

Tortrix indigestana, Meyr., Proc. Linn. Soc. N. S Wales, 1881, 520.

Of this widely distributed Australian species, not previously recorded from New Zealand, I took a good specimen at Whangarei in December, which I cannot distinguish from Australian examples.

PHALONIADÆ.

Heterocrossa contactella, Walk.

Tinea contactella, Walk. Suppl. 1813.

♀. 14–15 mm. Head white. Palpi 2½, white, lower longitudinal half blackish. Antennæ white, obscurely ringed with fuscous. Thorax whitish-ochreous mixed with dark grey, collar and patagia white. Abdomen pale greyish-ochreous. Fore-wings elongate, narrow, costa moderately arched, apex round-pointed, termen very oblique, almost straight, rounded beneath; grey, irregularly irrorated with dark grey and white; a broad irregular-edged white suffusion extending along anterior half of costa, and reaching ⅔ across wing; three or four small black dots on costa anteriorly, second forming a short strigula; a narrow oblique-transverse pale ochreous spot edged with black below middle at ½; a black dot above middle of disc, and a small pale ochreous sometimes blackish-mixed spot below it; three small faint whitish-ochreous spots arranged in a triangle in disc beyond middle; all these ochreous spots are ringed with white suffusion; an undefined angulated dark subterminal shade, marked with black on veins; a series of blackish dots on posterior half of costa and termen: cilia light grey irrorated with white, basal half obscurely barred with whitish. Hind-wings grey, paler anteriorly; cilia whitish.

Two specimens, Wellington. I have not actually compared these specimens with Walker's types, but from notes I made on a previous inspection I think there is little doubt of their identity; the species had not hitherto been rediscovered. It is intermediate between *adreptella* and the rest.

ŒCOPHORIDÆ.

Hypercallia aletis, sp. n.

♂. 13 mm. Head and thorax light fuscous sprinkled with whitish-ochreous. Palpi whitish-ochreous, a subapical ring of second joint, and terminal joint except apex somewhat infuscated. Antennæ greyish-ochreous, ciliations 3. Abdomen fuscous. Fore-wings elongate, moderate, costa gently arched, apex round-pointed, termen somewhat rounded, rather strongly oblique; greyish-ochreous irrorated with fuscous; some dark fuscous scales towards base of costa; first discal and plical stigmata very obscure, darker, plical rather obliquely beyond first discal; second discal distinct, dark fuscous, with some whitish scales beneath it: cilia greyish-ochreous

mixed with fuscous. Hind-wings rather dark fuscous, lighter anteriorly; cilia light fuscous, with darker subbasal shade, tips whitish.

I took one specimen on Arthur's Pass at 3000 feet, in January. It is an insect of the most obscure appearance, probably allied to the other New Zealand species of the genus, *H. amenena*, but differing obviously in the very much smaller size and dark hind-wings. These two outliers of a characteristic Australian genus are probably amongst the few indications of an immigration by way of Tasmania.

Proteodes profunda, sp. n.

♂. 20 mm. Head ochreous, mixed on sides with dark fuscous. Palpi dark fuscous, extreme apex of second and terminal joints pale ochreous. Antennæ fuscous. Thorax dark fuscous, somewhat mixed partially with whitish-ochreous. Abdomen dark fuscous mixed with ochreous-whitish; at base a pair of oblique narrow bladder-like membranes above. Fore-wings broad, suboblong, rather dilated posteriorly, costa moderately arched, apex obtuse, termen faintly sinuate, little oblique, rounded beneath; fuscous, with series of cloudy dots of black irroration on veins; markings formed by whitish-ochreous suffusion, irregularly sprinkled with dark ferruginous; about six irregular subconfluent spots towards base and anterior half of costa; a triangular subterminal patch extending from apex to tornus and leaving a narrow terminal streak of ground colour, its apex extending inwards to lower angle of cell; small discal spots of blackish suffusion before and beyond middle: cilia whitish-fuscous, basal half mixed with dark fuscous and whitish-ochreous, on costa with four pale dots. Hind-wings grey; cilia whitish-grey.

One specimen, Mount Holdsworth, in forest, at 2000 feet. This, the second discovered species of *Proteodes*, differs a good deal superficially from *P. carnifex*, and has a very Tortriciform appearance.

Trachypepla phæoptila, sp. n.

♂. 15 mm. Head ochreous-white, face and crown mixed with dark fuscous. Palpi white, basal third and a subapical band of second joint, and two bands on terminal joint blackish. Antennæ dark grey, ciliations $\frac{3}{4}$, even. Thorax fuscous sprinkled with whitish, mixed with dark fuscous anteriorly. Abdomen rather dark fuscous.

Fore-wings elongate, costa moderately arched, apex obtuse, termen oblique, rounded beneath ; fuscous, irregularly strewn with white, ochreous-brown, and black scales ; markings very undefined ; the black scales indicate an angulated basal patch, a large irregular blotch on middle of costa, some raised tufts in disc, and an apical patch ; the anterior edge of the costal blotch is margined with white suffusion ; an obscure roundish spot of brownish-ochreous suffusion beneath disc beyond middle : cilia fuscous, basal half mixed with white and blackish. Hind-wings dark fuscous ; cilia fuscous, with dark fuscous subbasal shade.

One specimen, Mangaterera River, Mount Holdsworth. Comparable with *T. anastrella* from the dark fuscous hind-wings, but apart from the more blackish mixture of fore-wings (which are also more elongate), differing widely in the antennal ciliations of ♂, which are short ($\frac{3}{4}$) and even, whilst in *anastrella* they are long (3) and whorled; this character is not noticed in my description of *anastrella*. The length of ciliations differs considerably in various species of *Trachypepla*, and appears to afford here specific characters only.

Trachypepla lathriopa, sp. n.

♂. 14–16 mm. Head and thorax brown. Palpi brownish-ochreous, sprinkled with dark fuscous, extreme tips of second and terminal joints whitish. Antennæ dark fuscous, ciliations $1\frac{1}{2}$, even. Abdomen rather dark fuscous. Fore-wings elongate, costa moderately arched, apex round-pointed, termen very obliquely rounded ; light reddish-fuscous, irregularly sprinkled with brown and dark fuscous ; edge of basal patch indicated by a very obscure pale acutely angulated narrow fascia ; stigmata dark fuscous, very undefined, plical rather obliquely beyond first discal ; a subterminal series of undefined dark fuscous dots, indented beneath costa ; a series of undefined dark fuscous dots along posterior part of costa and termen : cilia whitish-fuscous, tinged with reddish, with a grey postmedian shade. Hind-wings dark fuscous, lighter towards base ; cilia grey, with dark grey basal shade.

Six specimens, taken by myself at Wellington, Nelson, and on the Mt. Arthur plateau in January, and also received from Mr. Hudson. Very like obscure examples of *anastrella*, with which I have hitherto confused it, but obviously longer-winged, and certainly distinct by the much shorter and evenly-arranged ciliations of antennæ.

Izatha (*Semiocosma*) *metadelta*, sp. n.

♂. 17 mm, ♀. 19–25 mm. Head fuscous sprinkled with whitish, with well-marked conical horny frontal prominence concealed in scales. Palpi white, second joint mixed with dark fuscous, with dark fuscous basal and subapical bands, terminal joint mixed with dark fuscous at base, with dark fuscous median band. Antennæ dark fuscous ringed with whitish. Thorax whitish, mixed with fuscous in ♂, on patagia ochreous-tinged, anteriorly suffused with dark fuscous. Abdomen dark fuscous mixed with whitish, two basal segments ferruginous-ochreous. Fore-wings elongate, moderate, costa gently arched, apex obtuse, termen straight, rather oblique, rounded beneath; brownish-ochreous or fuscous, more or less sprinkled with whitish and dark fuscous, darkest in ♂, towards costa and dorsum suffused with whitish in ♀; dark fuscous marks at base of costa and dorsum; a small fuscous spot on costa at $\frac{1}{3}$, and a larger triangular one on dorsum at $\frac{1}{3}$, latter followed in ♀ by a patch of ochreous suffusion; a dark fuscous subquadrate spot on costa before middle, and a larger subtriangular one extending on costa from middle to $\frac{3}{4}$; two dark fuscous transverse discal spots before and beyond middle, touching these costal spots respectively, partially edged with black and then with white, first suboval, mostly filled with raised scales, second curved-reniform, lower posterior margin broadly interrupted; in ♂ two undefined longitudinal discal blackish streaks traversing these spots; an ill-defined cloudy whitish curved subterminal line; a terminal series of small dark fuscous spots: cilia fuscous sprinkled with whitish. Hind-wings in ♂ blackish-fuscous, in ♀ dark fuscous, lighter anteriorly; cilia fuscous, with darker basal shade.

Three specimens, Wellington. Nearest to *I. epiphanes*, but very distinct; the conical horny frontal prominence is a noticeable structure; it recurs (though previously unobserved because slight and concealed) in a less developed form in some but not all of the other species, and is doubtless adaptive.

Gymnobathra bryaula, sp. n.

♂. mm. Head and thorax ochreous-whitish, somewhat mixed with pale greenish-yellow, thorax with two small anterior dark fuscous spots. Palpi whitish, base and a subapical ring of second joint, and subbasal and subapical rings of terminal joint dark fuscous. Antennæ ochreous-whitish, basal joint dark fuscous above, ciliations 2. Abdomen ochreous-whitish, second segment more

ochreous. Fore-wings elongate, somewhat dilated posteriorly, costa moderately arched, apex obtuse, termen straight, oblique, rounded beneath ; ochreous-whitish, mixed with light greenish-yellow and sprinkled with dark fuscous, especially on veins ; markings fuscous mixed with dark fuscous ; small spots on base of costa and dorsum, a small double spot near base in middle, and three small double spots representing stigmata, plical obliquely beyond first discal ; two elongate marks above tornus ; a subterminal series of small subconfluent spots, approximated to termen, acutely indented beneath apex; five small spots on posterior half of costa : cilia ochreous-whitish, basal half spotted with dark fuscous (imperfect). Hind-wings ochreous-grey-whitish ; cilia whitish, with grey basal dots on veins.

One specimen, Wellington. Very distinct; might be placed between *sarcoxantha* and *thetodes*.

Borkhausenia (*Œcophora*) *penthalea*, sp. n.

♂ ♀. 15–17 mm. Head pale brownish-ochreous, whitish-sprinkled. Palpi ochreous-whitish, second joint with basal half dark fuscous and a subapical ring of dark fuscous irroration, terminal joint with subbasal and subapical rings of dark fuscous irroration. Antennæ grey, ciliations of ♂ 1. Thorax pale brownish-ochreous sprinkled with fuscous, anteriorly suffused with dark fuscous. Abdomen light grey. Fore-wings elongate, costa moderately arched, apex obtuse, termen very obliquely rounded ; whitish-ochreous, irrorated with light brownish, with some dark fuscous scales towards margins, sometimes forming distinct patches of dark suffusion on costa at base, ¼, and middle ; an oblique dark fuscous mark above dorsum before middle ; discal stigmata crescentic, dark fuscous, hollow beneath, often ill-defined ; a moderately broad subterminal fuscous or brown fascia, irrorated with dark fuscous, narrowed towards costa and on tornus: cilia whitish-ochreous irrorated with fuscous, at tornus with a darker bar above a pale spot. Hind-wings light grey, darker towards apex ; cilia grey-whitish, with grey basal shade.

Three specimens, Wellington. Allied to *griseata*; readily distinguished by the smaller size and well-defined dark fuscous subterminal fascia.

Borkhausenia chloradelpha, sp. n.

♂ ♀. 18–20 mm. Head whitish-ochreous. Palpi ochreous-whitish, basal half of second joint sometimes irrorated with dark fuscous. Antennæ whitish ringed with dark fuscous, ciliations of ♂ 1.

Thorax whitish-ochreous, with brown subdorsal stripes. Abdomen ochreous-whitish. Fore-wings elongate, costa moderately arched, apex pointed, termen faintly sinuate, rather strongly oblique ; pale whitish-ochreous, along dorsum and on posterior half more or less partially brownish-tinged and sprinkled with brown and dark brown ; a suffused brown streak, mixed with dark brown, along submedian fold from base to tornus ; stigmata fuscous, often indistinct, plical obliquely beyond first discal ; a subterminal line of dark fuscous scales very indefinitely indicated : cilia pale whitish-ochreous, more or less sprinkled with fuscous. Hind-wings and cilia ochreous-whitish.

Four specimens, Wellington. Intermediate between *griseata* and *politis*, but easily distinguished from both by the whitish-ochreous colouring, brown submedian streak, and whitish hind-wings.

Borkhausenia thranias, sp. n.

♂. 10 mm. Head and thorax orange-yellow. Palpi whitish-yellow, second joint irrorated with dark fuscous except towards apex. Antennæ dark fuscous, ciliations 1. Abdomen light silvery-grey. Fore-wings elongate, costa moderately arched, apex round-pointed, termen very obliquely rounded ; deep yellow, towards base orange-tinged ; a well-defined rather dark fuscous streak along costa from base to middle ; a few fuscous scales in disc beyond middle and towards tornus : cilia light ochreous-yellow. Hind-wings light grey ; cilia whitish-grey-ochreous.

One specimen, taken by myself at Whangarei in December. Nearest *horæa* ; characterised by small size, well-defined costal streak reaching middle, and absence of dark colouring on thorax.

Borkhausenia melanamma, sp. n.

♂. 12–14 mm. Head, palpi, and thorax grey irrorated with white. Antennæ dark grey ringed with whitish, ciliations 1. Abdomen grey, more or less mixed with ochreous-yellowish. Fore-wings lanceolate, costa bent at $\frac{1}{3}$; fuscous, irrorated with white, with a few scattered dark fuscous scales ; four oblique fasciæ of dark fuscous irroration from costa at base, $\frac{1}{3}$, $\frac{2}{3}$, and $\frac{5}{6}$ indicated or obsolete : cilia light fuscous, some irroration and tips whitish. Hind-wings grey ; cilia light grey, with darker basal shade.

Two specimens, Ida Valley, Otago, taken by Mr. J. H. Lewis. Near *siderodeta* ; similar in form of wing but differs by the white irroration (causing grey appearance),

absence of ochreous-yellow or ferruginous suffusion, and lighter hind-wings. Both species evidently vary considerably, but I have taken *siderodeta* in plenty, and in all its forms it is clearly distinct from *melanamma*.

Borkhausenia loxotis, sp. n.

♂. 11–12 mm. Head and palpi dark fuscous irrorated with ochreous-whitish. Antennæ dark fuscous, pale-ringed. Thorax and abdomen dark fuscous. Fore-wings elongate, costa moderately arched, apex round-pointed, termen very obliquely rounded; dark fuscous; some scattered pale yellowish scales along submedian fold; a narrow straight pale ochreous-yellowish fascia, edged with some black scales, from $\frac{1}{4}$ of costa to $\frac{2}{3}$ of dorsum; a pale ochreous-yellow dot in disc at $\frac{2}{3}$, and sometimes others on costa beyond middle and at tornus; a more or less indicated subterminal line of pale yellowish scales, starting from a small costal spot: cilia fuscous, irrorated with yellow-whitish. Hind-wings dark fuscous; cilia fuscous, with darker basal shade.

I took one specimen at Wellington in January, and have received another from Mr. Hudson. It is intermediate between *siderodeta* and *chrysogramma*, but quite distinct from either.

Borkhausenia pharmactis, sp. n.

♂. 15 mm. Head fuscous, sprinkled with pale yellowish hairs. Palpi whitish-yellowish, sprinkled with dark fuscous. Antennæ whitish-yellowish, ringed with dark fuscous. Thorax ochreous-yellow, anteriorly suffused with fuscous. Abdomen grey. Fore-wings elongate, costa gently arched, apex obtuse, termen slightly rounded, rather strongly oblique; deep ochreous-yellow, finely sprinkled throughout with brown; extreme costal edge dark fuscous towards base: cilia ochreous-yellow, somewhat sprinkled with brown. Hind-wings dark grey; cilia whitish-grey, with grey basal shade.

I took one specimen on the Mount Arthur plateau, at an elevation of 4000 feet, in January. Perhaps allied to *anæma*, but much deeper-coloured, and quite without the dark costal streak and other markings.

PLUTELLIDÆ.

PHYLACODES, gen. n.

Head with appressed scales; ocelli present; tongue developed. Antennæ $\frac{3}{4}$, in ♂ shortly ciliated, thickened above with scales on

basal half, basal joint moderate, without pecten. Labial palpi long, recurved, with appressed scales, second joint somewhat roughened beneath towards apex, terminal joint longer than second, acute. Maxillary palpi short, slender, acute, porrected. Posterior tibiæ smooth-scaled above, loosely haired on apical half beneath. Fore-wings: 2 from very near angle of cell, 7 and 8 stalked, 7 to termen, 11 from middle of cell. Hind-wings slightly over 1, subtrapezoidal, termen slightly sinuate, cilia $\frac{2}{3}$; 3 and 4 rather approximated at base, 5, 6, 7 parallel.

Not obviously near to any described genus.

Phylacodes cauta, sp. n.

♂. 14 mm. Head and thorax light brownish-ochreous, slightly purplish-tinged. Palpi whitish-ochreous, slightly fuscous-sprinkled, especially beneath apex of second joint. Antennæ pale greyish-ochreous. Abdomen dark grey, anal tuft white. Fore-wings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; light greyish-ochreous, on costal half suffused with ochreous-white, especially on veins; several minute black dots along submedian fold, dorsum, and termen, and towards apex; a larger round dot in disc at $\frac{3}{4}$: cilia ochreous-whitish. Hind-wings grey, becoming blackish-grey towards apex; cilia light grey, with dark grey basal shade, tips whitish.

One specimen, Ida Valley, Otago, taken by Mr. J. H. Lewis.

Orthenches drosochalca, sp. n.

♂ ♀. 11 mm. Head and thorax leaden-grey. Palpi dark fuscous, inwardly and towards base white, terminal joint half as long again as second ($1\frac{1}{2}$). Antennæ dark fuscous, ringed with white. Abdomen grey, towards base pale ochreous, apex in ♂ whitish. Fore-wings elongate, costa moderately arched, apex pointed, termen sinuate, rather strongly oblique, rounded beneath; 7 to termen; shining coppery-bronze; four oblique fasciæ of white irroration, first slender, second antemedian, broader, third angulated, considerably enlarged towards costa, fourth forming an apical patch extended along termen; a spot on base of costa, an interrupted streak along submedian fold, and a spot above middle of disc purple; a dark fuscous-purple transverse mark in disc at $\frac{2}{3}$, in third fascia: cilia light grey, above apex spotted basally with purplish. Hind-wings ovate-lanceolate, apex acute, termen sinuate; light grey, darker posteriorly; cilia whitish-grey.

I took a specimen in the Otira Gorge in January, and have received another from Mr. Hudson, taken in Welling-

ton. Allied to *porphyritis*, and similar in form of wing, but structurally distinct by vein 7 of fore-wings running to termen, not apex, and terminal joint of palpi 1½ instead of 2, as well as by the clear coppery-bronze colouring and lighter hind-wings.

Compsistis orthophanes, sp. n.

♀. 9–10 mm. Head, antennæ, and thorax dark bronzy-fuscous. Palpi rather dark fuscous, internally whitish-ochreous, terminal joint as long as second. Abdomen dark fuscous, apex whitish-ochreous. Fore-wings elongate, narrow, costa gently arched, apex round-pointed, termen very obliquely rounded; fuscous, slightly purplish-tinged, irrorated with dark fuscous and blackish; a straight rather narrow fascia at ¼, a small spot in middle of disc, and opposite subcostal and subdorsal spots at ¾ pale ochreous-yellow, irregular-edged: cilia fuscous, mixed with dark fuscous towards base. Hind-wings dark fuscous; cilia fuscous, with dark fuscous basal shade.

Two specimens taken by myself at Auckland and Nelson, in December and January.

TINEIDÆ.

Dryadaula myrrhina, sp. n.

♂. 9 mm. Head, palpi, antennæ, and thorax ochreous-whitish. (Abdomen broken.) Fore-wings elongate, rather narrow, costa gently arched, apex round-pointed, termen faintly sinuate, extremely oblique; 7 and 8 separate; shining, whitish-yellowish; two very oblique triangular fuscous spots on costa about ⅛ and before middle; a fuscous dot above dorsum at ⅓; an inwardly oblique fuscous strigula on dorsum at ⅔; a fuscous costal dot at ¾; some indistinct brownish suffusion on dorsal half posteriorly and towards apex; a thick black terminal line, interrupted below apex and in middle: cilia whitish-yellowish. Hind-wings trapezoidal, termen faintly sinuate below apex; light grey; cilia grey-whitish.

One specimen, probably from Wellington. Nearly allied to the Australian *D. glycinopa*, under which name I now believe I confused two distinct species; I therefore add diagnoses of these, to show that all three are distinct.

Dryadaula glycinopa, Meyr.

Dryadaula glycinopa, Meyr., Proc. Linn. Soc. N.S. Wales, 1892, 559 (part).

♂. 9–10. (Antennæ broken.) Fore-wings with 7 and 8 stalked; shining whitish-yellowish; very oblique ochreous-yellow fascia-like

streaks from costa at $\frac{1}{5}$ and before middle, and a blotch on costa about $\frac{2}{3}$, all marked with dark fuscous on costal edge ; a suffused ochreous-yellow streak along submedian fold, and indications of two or three oblique streaks from dorsum coalescing with it ; an incomplete fine dark fuscous line from about $\frac{3}{4}$ of disc to apex ; an irregular blackish line along termen, tending to be interrupted below apex and in middle. Hind-wings subtrapezoidal, termen not sinuate ; grey, lighter toward base.

Two specimens, Blackheath, New South Wales, in February.

Dryadaula napæa, sp. n.

Dryadaula glycinopa, Meyr., Proc. Linn. Soc. N.S. Wales, 1892, 559 (part).

♀. 8 mm. Antennæ towards apex with three dark fuscous bands. Fore-wings with 7 and 8 short-stalked ; white ; very oblique ochreous-yellow fascia-like streaks from costa at $\frac{1}{6}$ and $\frac{1}{3}$, marked with fuscous on costa, meeting in disc two shorter oblique ochreous-yellow streaks from dorsum ; a deep ochreous-yellow streak along submedian fold from base ; a triangular fuscous blotch extending on costa from middle to $\frac{4}{5}$, connected with termen by a yellow-ochreous suffusion ; a fuscous spot on costa near apex ; an incomplete line of dark fuscous scales from $\frac{2}{3}$ of disc to termen beneath apex, space beneath this mostly suffused with yellow-ochreous ; blackish dots at apex and tornus, connected by an incomplete row of blackish scales along termen. Hind-wings broadly lanceolate, pale grey.

One specimen, Deloraine, Tasmania, in November.

XIII. *On three remarkable new genera of* Microlepidoptera.

By Sir George F. Hampson, Bart., B.A.

[Read March 1st, 1905.]

PYRALIDÆ.

Chrysauginæ.

Genus Pachypodistes, nov.

Proboscis aborted; palpi not projecting beyond frons and very thickly clothed with hair; maxilliary palpi absent; frons with thick tuft of hair; antennæ ciliated; legs of male thickly clothed with hair, the fore tarsi fringed with hair, the mid and hind tarsi with immense tufts of hair on upper-side, the spurs absent, female with the tibiæ and tarsi smoothly scaled and very much swollen, the tarsal joints indistinct, the spurs absent; abdomen very long, especially in female where the anal segment is twice the length of the others. Fore-wing with the costa concave and the apex produced upwards, especially in male, the termen strongly excurved; vein 3 from angle of cell; 4-5 stalked in male, approximated for some distance in female; the upper angle of cell produced, especially in male, 6 from angle in male, in female shortly stalked with 7, 8, 9, 10; 11 from cell. Hind-wing with the inner angle thickly clothed with hair; vein 3 from angle of cell; 4, 5 stalked in male, approximated for some distance in female; 6, 7 stalked, 7 anastomosing with 8.

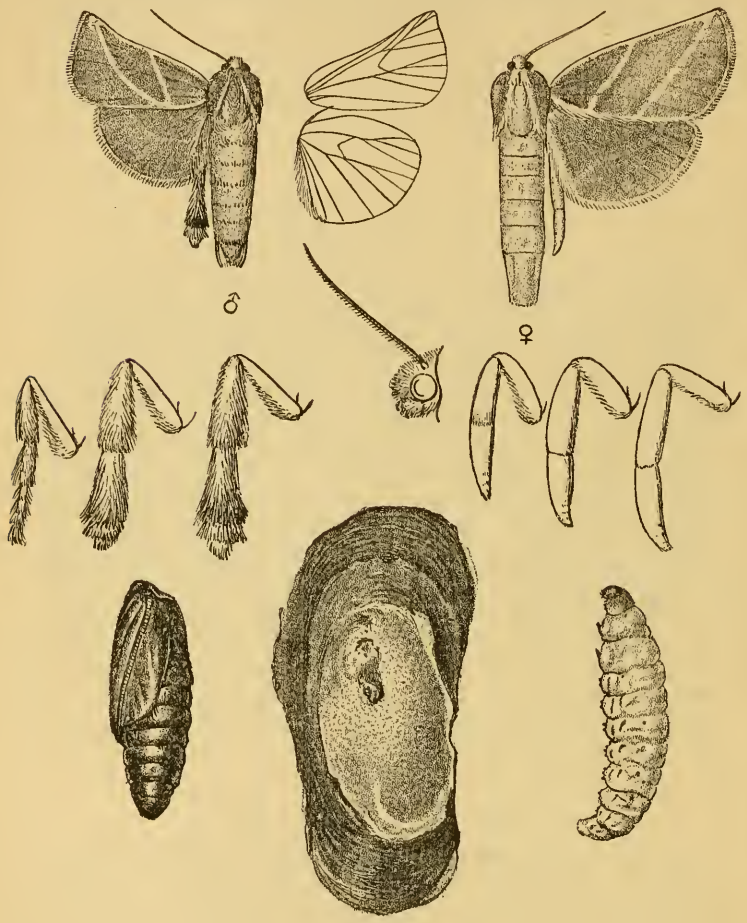
The genus is best placed in the *Chrysauginæ* in spite of the absence of proboscis.

Pachypodistes goeldii, n. sp.

♂. Head and thorax greyish-ochreous mixed with fuscous-brown; patagia dull vinous-red irrorated with grey and edged with ochreous; hind tarsi tinged with vinous-red, the fringe of hair dark brown at tips; abdomen ochreous-brown, the ventral surface tinged with vinous-red. Fore-wing vinous-red irrorated with greyish-ochreous especially on costa and inner margin; an oblique grey antemedial line joined at inner margin by a very obliquely curved line from costa near apex below which it is slightly angled; cilia brownish-ochreous. Hind-wing vinous-red irrorated with greyish-ochreous,

an indistinct very obliquely curved postmedial greyish line ; cilia brownish-ochreous ; the inner margin clothed with long brownish hair.

♀. Wings much brighter vinous-pink ; fore-wing with the post-



Pachypodistes goeldii, ½

medial line oblique, not curved and well separated from the antemedial line at inner margin.

Larva a whitish stoutly-built grub with red-brown head, evidently an internal feeder. *Cocoon* red-brown, flattened, bivalvular, formed

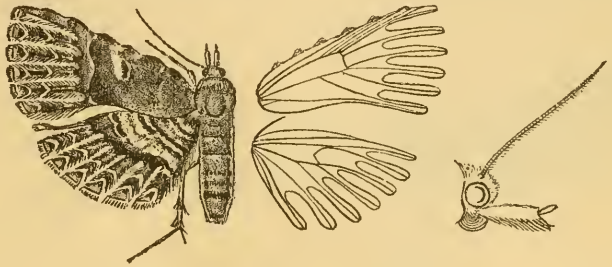
in layers and rather resembling a mussel-shell, probably attached to bark or between leaves.

Hab. AMAZONS, Pará (Goeldi), 1 ♂, 2 ♀, larva, pupa and cocoons. Exp. ♂ 38, ♀ 50 mm. Type in B. M.

ORNEODIDÆ.

Genus TRISCÆDECIA, nov.

Proboscis fully developed ; palpi with the 2nd joint porrect about twice the length of head and broadly fringed with hair below, the 3rd oblique, moderate ; antennæ of male ciliated ; tibiæ with projecting tufts of hair at the spurs. Fore-wing divided into six plumes to rather more than one-third length ; the costa with six tufts of scales ; the scaling rough ; vein 3 from well before angle of cell ;



Triscædecia dactyloptera, ♂ ♀.

4–5 from angle ; 6 from below upper angle ; 7–8 stalked ; 9, 10, 11 from cell. Hind-wing divided into seven plumes to half length ; veins 3–4 from angle of cell ; 5 absent ; 6–7 from upper angle ; 8 free, from base.

This is the third known genus of the family, the others being *Orneodes*, Latr., and *Pælia*, Wlk.

Triscædecia dactyloptera, n. sp.

♂. Head, thorax and abdomen clothed with whitish, pale brown and black scales ; antennæ and legs mixed with whitish ; abdomen with diffused blackish bands. Fore-wing clothed with greyish, pale brown and black scales ; the costa with whitish spots between the black tufts of scales ; the cell with small black lunules followed by whitish spots at middle and extremity ; traces of a diffused oblique whitish band from lower angle of cell to inner margin ; an indistinct slightly waved whitish postmedial line ; the plumes with

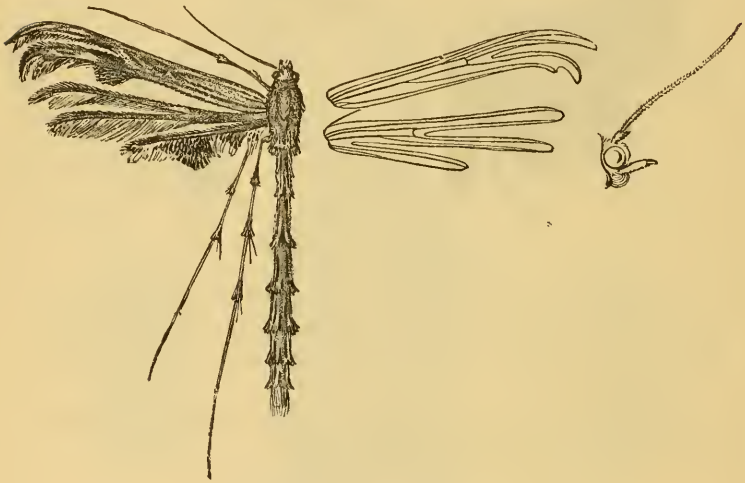
white spots at base and subterminal and terminal series of white lunules. Hind-wing with the basal half white with diffused irregular black antemedial and two medial lines on it, the 1st of the medial lines arising from a discoidal bar; a slightly waved whitish post-medial line; the plumes with white spots at base and subterminal and terminal series of white lunules.

Hab. Ceylon, Maskeliya (J. Pole), Ohiya (Gossage). Exp. 26 mm. Type in B. M.

PTEROPHORIDÆ.

Genus Titanoptilus, nov.

Proboscis fully developed; palpi porrect, slender, projecting about the length of head; antennæ with the shaft roughly scaled, the basal joint with large tuft; fore femora with tuft of scales near



Titanoptilus melanodonta, ♂ $\frac{2}{3}$.

extremity, the tibia with large tuft at extremity; mid tibiæ with tufts at middle and extremity; hind tibiæ with three tufts; abdomen very long with lateral tufts of scales at extremity of segments. Fore-wing bifid to near middle, the lower plume falcate at extremity; a very large scale-lobe on inner margin below end of cell; vein 3 absent; 5 absent; 6 from below upper angle of cell; 7–8 stalked; 9–10 absent; 11 from cell. Hind-wing trifid, the upper excision to two-thirds, the lower to near base; the inner margin with large

scale-tooth at one-third and very large scale-lobe at two-thirds; veins 3, 5 and 6 absent.

Nearest to *Trichoptilus*, Wlsm.

Titanoptilus melanodonta, n. sp.

♂. Head, thorax and abdomen clothed with grey, brown and black scales. Fore-wing greyish suffused with dark brown and irrorated with rough black scales; a whitish mark at base of excision, the fringes of scales below upper plume and above lower black and whitish; the lobe on inner margin formed of large black scales, the lower plume fringed below with black and whitish scales and with a scale-tooth before its falcate extremity. Hind-wing greyish suffused with dark brown; a few black scales in the fringes below and at extremity of the two upper plumes; the inner margin with the long spatulate scales of the scale-tooth and lobe pale at base, black at extremities; a tuft of black scales at extremity of plume with the fringe on inner margin before it white.

Hab. British E. Africa, N'dimu, Uganda Ry., mile 469. (Betton), ♂. Exp. 42 mm. Type in B. M.

XIV. *Descriptions of some new species of* Diurnal Lepidoptera, *collected by Mr. Harold Cockson, in Northern Rhodesia, in* 1903 *and* 1904. By Herbert Druce, F.L.S. Lycænidæ and Hesperiidæ, by Hamilton H. Druce, F.Z.S.

[Read March 1st, 1905.]

Plate XIII.

The collection contains a large number of species, the most interesting being *Planema poggei*, *Precis touhilimasa*, *Crenis rosa* ♂ and ♀, *Pseudacræa poggei*, *Eurytela plistonax*, *Eurytela lætitia* ♂ and ♀, *Crenidomema concordia* ♂ and ♀, *Charaxes macclounii* ♂ and ♀, *Teracolus regina*, *Papilio ridleyanus*, *Papilio toborunus*.

We have described 11 as new species, leaving several others, of which only one specimen has been sent, for future determination.

Family *SATYRIDÆ*.

Mycalesis cooksoni, sp. nov. (Plate XIII, fig. 1.)

♂. Upper-side. Primaries and secondaries dark brown, the fringes of both wings lighter brown. Primaries with a small indistinct apical ocellus, a large black ocellus near the anal angle with a small white dot in the middle, a short oblique cream-coloured band crosses the wing from the costal margin to the upper-side of the black ocellus.

Under-side. Primaries greyish-brown crossed beyond the middle by a narrow yellow curved line, the cream-coloured band as above but smaller, the ocellus more distinct, two fine yellow lines close to the base. Secondaries greyish-brown mottled with darker brown, a blackish-brown line crosses the middle of the wing from near the apex to the inner margin above the anal angle, a submarginal row of minute black dots extending from near the apex to the anal angle, those near the anal angle the largest.

Expanse 2 inches.

Hab. North-west Rhodesia.

This species is allied to *Mycalesis sciathis*, Hew., from Old Calabar, and *M. sclousi*, Butl.

Mycalesis haroldi, sp. nov. (Plate XIII, fig. 2.)

♂. Head, antennæ, palpi, thorax and abdomen brownish-black, under-side of the abdomen and the legs pale brown. Upper-side: Primaries cream-colour broadly shaded with brown at the base, the costal margin apex and outer margin dark brown, a small indistinct ocellus close to the apex, a large ocellus nearest the anal angle, a faint submarginal line extends from the apex to the anal angle. Secondaries cream-colour, the base and inner margin clouded with brown, the apex and outer margin dark brown with a faint submarginal line extending from the apex to the anal angle.

Under-side: both wings pale brown. Primaries crossed beyond the middle of a cream-coloured band which widens out to the anal angle, two large ocelli close to the outer margin, the first near the apex, the second above the anal angle; a marginal and submarginal pale greyish band extends from the apex to the anal angle. Secondaries crossed about the middle by a rather wide cream-coloured band, a submarginal row of six ocelli extending from the apex to the anal angle, the first large, second and third very small, four and five large, six small. The marginal lines the same as on the primaries.

Expanse 2 inches.

Hab. North-western Rhodesia.

LYCÆNIDÆ.

Amongst the *Lycænidæ* are many interesting species, showing an admixture of Western and South Tropical forms. The collection contains *Alæna oberthuri*, Auriv., a species with uniform black hind-wings on the upper-side, a good series of *Pentila amenaida*, Hew., showing considerable variation as regards the richness of colour and the number of black spots; *Mimacræa marshalli*, Trimen, in fine condition; a large series of the little-known *Terias*-looking *Liptena homeyeri*, Dewitz.* A ♀ specimen agreeing exactly with Dr. Trimen's figure of *Epamera trimeni*, Walleng., which if this is the true *Trimeni* makes one doubt whether the insects from the Transvaal referred by Mr. G. A. K. Marshall to this species are correctly determined or whether Dr. Trimen's figure really refers to *Trimeni* or some other unnamed form. *Zeritis sorhageni*, Dewitz, and *Z. neriene*, Boisd., agreeing exactly with Boisduval's figure, and in my opinion quite distinct from Dr. Butler's *Z. amine*. *Aphnæus erikssoni*, Trimen.

* *Homeyeri*, Dewitz, D. E. Z., 30, p. 429, t. 2, f. 5, 5*a*, 5*b*, 5*c*.

Spalgis lemolea, H. H. Druce, known from the Gambia. *Lycænesthes adherbal*, Mabille, *L. lasti*, S. and K., *L. liodes*, Hew., *L. crawshayi*, Butl., *L. defina*, Butl., and *L. monteironis*, Kirby, agreeing exactly with the type in the Hewitson collection.*

Uranothauma antinorii, Oberth., *U. falkensteinii*, Dewitz, and a large series of *U. poggei*, Dewitz, showing scarcely any variation. *Castalius hintza*, Trimen, *C. calice*, Hopff., and *C. melæna*, Trimen. *Catochrysops glauca*, Trimen, a good series, *C. peculiaris*, Rogenh., and the giant *C. stormsi*, Robbe.

I recognize in all about sixty species, including the new forms hereafter described.

Liptena eukrines, sp. nov. (Plate XIII, fig. 7.)

♂. Allied to *L. præstans*, Grose Smith,† from which it differs on the upper-side by the black costal margin on the primaries being broken beyond the end of the cell, and projecting downwards, thus freeing the black apex; the outer margin has only a linear black edge and the secondaries are unmarked excepting at the base of the cilia, where there appears to be a very narrow black line. Under-side: primaries differ from those of *L. præstans*, as on upper-side; secondaries, ground colour pale grey dusted with brown and crossed by numerous broken bands composed of irregular brown spots.

Head black; eyes ringed with white; legs yellowish; abdomen yellowish above, grey beneath; antennæ white-ringed, with black clubs.

Expanse $1\frac{3}{16}$ inch.

Hab. North-east Rhodesia.

Three specimens showing no variation. This species agrees in venation with *L. libyssa*, Hew. ‡; the upper radial on fore-wing originating at end of cell as in that species. It has close superficial resemblance to *Teriomima*.

* Since the above was written, Mr. Bethune-Baker has shown me M. Mabille's type of *L. adherbal*, and pointed out that it is identical with *L. monteironis*, Kirby, and has priority. With this conclusion I quite agree. The species I have in this paper referred to as *L. adherbal* should be known as *L. lunulata*, Trimen.

† *Liptena præstans*, Grose Smith, Rhop. Exot. African *Lycænidæ*, pl. xxix, f. 15, 16, p. 141 (1901).

‡ *Liptena libyssa*, Hew., Exot. Butl., *Pentila* and *Liptena*, t. 1, f. 5, 6 (1866).

Iridopsis cuprepes, sp. nov. (Plate XIII, fig. 8.)

♂. Closely allied to *I. exquisita*, Grose Smith.* Upper-side: black margins more distinctly defined and rather narrower. Under-side: primaries with four pale spots beyond the cell, the upper one small, the two median quadrate, large and distinct, the lower spot rounded and less distinct, below these there is an indication of a fifth spot. There are three pale patches at the outer angle, large and distinct. Secondaries; the median band appears wider and more broken, and the marginal coloured band containing the metallic lunules is wider.

Expanse 1⅝ inch.

Hab. North-west Rhodesia.

Mr. Cookson only sent one specimen. Although this insect is undoubtedly very close to *I. exquisita*, I believe that, judging from analogy in the genus *Phytala*, it will prove to be distinct.

The species of this genus are very little known and seldom seen in collections. We have in our possession a ♀ specimen from Sierra Leone, which is exactly like Mr. Grose Smith's figure of *I. ansorgei*,† and I have no doubt that it is the ♀ of *I. incredibilis*, Staud., the ♂ of which is figured in Iris 4, t. 1, f. 7, 1891.

Spindasis kallimon, sp. nov. (Plate XIII, fig. 9.)

♀. Upper-side. Primaries blackish-brown with distinct orange bands formed of quadrate spots. The 1st in, and at the end of the cell, consisting of a quadrate spot and a triangular spot below it; a large quadrate spot beyond, joining at the median nervule to an irregular band consisting of six confluent spots which reach from the apex to near the outer angle. The inner margin from the base for about two-thirds its length and extending to the lower median nervule pale silvery blue. Secondaries pale greyish-brown with the under-side bands showing through as darker grey patches; a deep black outer marginal line. Anal angle largely deep orange, containing a small black spot and two small patches of metallic scales. Ciliæ of both wings distinctly and evenly deep orange, except at the anal angle where it is deep black. The tail on the lower median

* *I. exquisita*, Grose Smith, Nov. Zool., 5, p. 353 (1898), Rhop. Exot. African *Lycænidæ*, pl. xxviii, f. 12, 13 (1901).

† *I. ansorgei*, Grose Smith, id. p. 354, Rhop. Exot. id. f. 10, 11.

nervule is black, tipped with white, that on the submedian nervures being orange tipped with black. Under-side: Both wings pale yellow with dark orange red-bordered bands, which incline to rounded spots, thickly lined interiorly with metallic scales. At the base of the fore-wing is a bright orange costal dash. There is a marginal narrow red line and two submarginal more prominent red lines to both wings.

A rather large marginal black spot at the anal angle below the submedian nervule and a smaller one crowned with metallic scales in the submedian interspace. Head dark orange without any black markings. Thorax and abdomen blackish above, pale yellow below; abdomen ringed with whitish.

Legs pale yellow; palpi pale yellow below, darker above with black tips.

Expanse $1\frac{3}{10}$ inch.

Hab. North-west Rhodesia, January 1903.

A very beautiful and distinct species, not nearly allied to any that I can find described, but perhaps nearest to *S. homeyeri*,* Dewitz. Mr. Cookson sent four specimens, all females.†

Erikssonia cooksoni, sp. nov. (Plate XIII, fig. 4.)

♂. Allied to *Erikssonia acræina*, Trimen.‡ Upper-side uniform reddish-brown. Primaries with the costa (except at the base, which is reddish-brown) increasingly broadly black for about three-fourths its length when it becomes suddenly narrow and joins the broad evenly black outer margin. An elongate black spot at the end of the cell. Cilia deep black. Secondaries with a gradually increasing outer marginal black band, commencing beyond the middle of the costa and becoming narrow and broken about the region of the median nervure,

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* *Spindasis homeyeri*, Dewitz, D. E. Z., 30, p. 429, t. 2, f. 5, 5*a*, 5*b*, 5*c*.

† Since the above description was written, Professor Poulton has sent me for examination a ♂ captured at Rabai, 14 miles N.W. of Mombasa on June 18th, 1903, by Rev. K. S'Aubyn Rogers, and presented by him to the Oxford Museum. It differs from the ♀ on the upper-side by the orange bands on the primaries being narrower and rather less conspicuous and by the hind-wing being suffused with rich purple from the subcostal to the submedian nervure; in this respect somewhat resembling *spindasis natalensis*, Westw., which has the inner margin of the fore-wing also broadly suffused. On the under-side it is identical with the ♀.

‡ *Erikssonia acræina*, Trimen, P. Z. S., 1891, p. 92, Pl. IX, f. 18, 19, 20.

and continuing narrowly to the anal angle where there is a black line placed obliquely just above it. The cilia is black, whitish at the base between the nervules. Under-side: Primaries rich orange, paler along the inner margin; black spots arranged as in *E. acræina* with an additional black spot below the cell placed below the central cell spot. The outer margin is broadly paler, bordered inwardly with a black line, heavily covered with metallic silver scales and divided by the black nervules. Cilia black. Secondaries: Ground colour pale buff with the black spots large and distinct, the basal area suffused with bright carmine, and a bright carmine band placed between the ultra-median row of black spots and the sub-marginal black line. Outer margin and metallic scaling as in primaries.

Legs reddish-orange; palpi orange below, black above. Antennæ black; brownish at the extreme tip. Head black, yellow between the eyes. Abdomen deep orange-red above with a row of black spots; sides deep black with white spots; under-surface clothed with more or less orange hairs.

Expanse $1\frac{7}{10}$ inches.

Hab. North-west Rhodesia.

Although doubtless allied to *E. acræina* this insect appears to have many points of distinction, notably the broad black outer marginal border to the fore-wing above; the deep black cilia; and the carmine on the under-surface of the hind-wings. It is also a larger insect.

Cooksonia, gen. nov.

Allied to *Erikssonia*,* Trimen, from which it differs in the fore-wing by the 4th subcostal nervule being emitted nearer to the base and by the subcostal nervure reaching the margin further below the apex; and in the hind-wing the stalk of the submedian nervure is much shorter. The antennæ are longer and when viewed from above appear to be but slightly thickened at the extremities, but when examined from the side they present a broadly spatulate club, in this respect entirely differing from *Erikssonia*.† The palpi which are not clothed with thick scales to anything like the same extent have the terminal joint less than half as long; almost minute.

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* *Erikssonia*, Trimen, P. Z. S., 1891, p. 91.

† This may possibly be due to pressure in packing the specimen, which, however, shows no signs of flattening as regards the abdomen or thorax, and is in very perfect condition.

Type. *Cooksonia trimeni*, sp. nov.

I have compared this genus to Dr. R. Trimen's *Eriksonia*, but it presents important differences which may prove more remarkable when the male sex is examined. I dedicate it to Mr. Cookson, its discoverer.

Cooksonia trimeni, sp. nov. (Plate XIII, fig. 3.)

♀. Upper-side. Orange-ochreous, suffused with reddish-ochreous, deepening in colour towards the bases, brightest in the fore-wing.

Primaries: Costal margin narrow and evenly black, outer margin rather more broadly black; apical third pure white, inwardly bordered with a rather broad black band, comparatively straight and even on its inner edge, and much suffused and irregular on its outer edge, reaching from the costa to the outer margin, where it is broadest; the nervules crossing this white apex being distinctly black and being more decidedly conspicuous as they recede from the apex. A large black spot at the end of the cell and a smaller black spot beyond the middle of the cell placed near to but apart from its upper wall.

Secondaries: With a black border, commencing very narrowly beyond the middle of the costal margin, gradually and evenly widening towards the apex whence it becomes broken and though thickening at the extremities of the median nervules is very narrow along the inner margin and disappears before the base is reached. A distinct black spot at the end of the cell placed well above the median nervure.

Under-side. Primaries brownish-ochreous, reddish in the cell; a distinct black spot at the end of the cell. The apical third consists of a series of five narrowly black-bordered greyish conical spots placed between the nervures, each one containing at its marginal base an indistinct ochreous patch. The outer margin has a linear black border.

Secondaries pearly-grey, with the inter-nervular spaces more or less suffused with reddish-brown scales which are most conspicuous just beyond the middle. The basal half contains about twelve large black irregular white-ringed spots, several of which, close to the base are confluent, and a median row of irregular black dots. The outer margin is bordered with a linear black band; beyond which are two rows of angular black markings placed between the nervules, the outer row enclosing ochreous patches, the inner pale grey.

Head black, with two white spots behind the bases of the antennæ and two white streaks between the eyes.

The upper part and the sides of the abdomen are ochreous, but on the under-side of each segment there is a large distinct, white, black-margined spot. There are also white spots on the under-side of the thorax. The legs are black with yellow tufts at the base.

Antennæ black; the shafts minutely spotted with white on the under-surface.

Expanse $2\frac{1}{8}$ inch.

Hab. North-east Rhodesia. October 1903.

On the under-side this insect has a remarkable *Acræine* appearance, but although the upper-side has a general likeness to that group I know of no species of the genus *Acræa* which has the large white apex to the fore-wing.

Lycænesthes anadema, sp. nov. (Plate XIII, fig. 6.)

♂. Allied to *L. lasti*,* Smith and Kirby, but smaller. Upper-side: dark purple with indistinct black marginal spots between the lower median nervules on hind-wing. Under-side: ground colour rather deeper in tone with the whitish chain-like bands less inclined to break up into spots and with their enclosed spaces scarcely darker than the surrounding ground colour. The red spots on the hind-wing, with the exception of the one below the costal nervure near the base, which is entirely absent, are dark, clearly defined, and conspicuous. The black, yellow-crowned marginal spot placed between the lower median nervules is smaller, as is the orange anal-angular streak. Thorax, abdomen, head and legs as in *L. lasti*. Cilia on upper-side pale brown, whitish towards tip.

Expanse $1\frac{1}{6}$ inch.

Hab. North-west Rhodesia.

Can be distinguished by the smaller size and by the absence of the red basal spot on hind-wings below.

It is also allied to *L. hobleyi*,† Neave, but that species had a red basal spot and also a red cellular spot in hind-wings.

Catochrysops pampolis, sp. nov. (Plate XIII, fig. 11.)

♂. Upper-side: pale opalescent bluish brown with a linear brown margin and brown nervules to both wings; a slightly darker brown patch at the end of the cell of the fore-wing, containing a still darker streak. A medium-sized round black spot close to the margin of the

* *L. lasti*, Smith and Kirby, Rhop. Exot., 27. Afr. Lyc., p. 109, t. 24, f. 1, 2, 1894.

† *L. hobleyi*, Neave, Nov. Zool., v. xi, p. 339, 1904.

hind-wing, placed between the two lower median nervules. Cilia white, indistinctly darker at the extremities of the nervules. Under-side : ground colour of both wings pure white with broad blotches. Primaries ; a large quadrate blotch at the end of the cell ; costal margin pale brown ; an ultra-median brown band composed of confluent quadrate spots, semi-circular in form, reaching from the subcostal nervure, where it is widest, to lower median interspace where it is narrowed ; beyond this a rather narrow brown band of confluent inter-nervular patches, followed by a somewhat paler and narrower brown band reaching only to the lower median nervules, and beyond this a clearly defined, narrow, marginal line. Cilia white ; dusky at the ends of the nervules. Secondaries : costal margin pale brown ; two large black spots close to the margin, one about the middle, one half-way between this and the base ; a triangular black spot at the base of the cell, and two more along the anal margin ; a large irregular dark brown blotch, with several smaller blotches more or less attached to it, occupying the central area, and a double submarginal brown band more inclined to become fused towards the anal angle. Close to the margin between the lower median nervules is a large oval orange spot centered by a black spot which is crowned exteriorly by rich metallic-blue scales. In the submedian interspace, close to the submedian nervure is an orange streak bordered on either side by a small black spot ; cilia white, brownish at the extremities of the nervules.

Head, thorax and abdomen brownish-grey above, white beneath. Legs white ; palpi white, with black tips. Antennæ black, white ringed.

A short linear brown tail on the lower median nervule.

♀. Upper-side paler and brighter blue than ♂, fore-wing with apex and outer margin broadly pale brown ; hind-wing with an ultramedian, semicircular, irregular whitish band. Under-side : the white areas more extensive than in ♂, causing the brown blotches to appear more distinct ; the costal margin and the basal area are more broadly pale brown and the black spots appear white ringed.

Expanse ♂ $1\frac{7}{10}$ inch, ♀ $1\frac{9}{10}$ inch.

Hab. North-west Rhodesia, November 1903.

Not very closely allied to any species that I can find described.

Catochrysops skotios, sp. nov. (Plate XIII, fig. 12.)

♂. Upper-side uniform dark olivaceus-brown, primaries with a darker streak at the end of the cell. Cilia slightly paler brown. Underside : ground colour olivaceus-brown, but slightly paler than

upper-surface, with sordid white-ringed spots and markings. Primaries : a large spot at the end of the cell ; an ultramedian band of six chain-like spots running almost in a straight line from the subcostal nervure to the submedian nervure, the two lower links being placed slightly nearer to the base, then two submarginal rows of pale sagittate lunules and a pale marginal line. Secondaries : two distinct black spots on the costal margin, another about the middle of the cell, and two more on the anal margin, one about the middle, the other near the base. A large sordid white-ringed brown spot near the end of the cell, then an irregular, much broken band consisting of sordid white-ringed spots, commencing below the black spot near the middle of the costal margin and reaching to the submedian nervure ; beyond this band are two rows of sagittate pale markings and a pale marginal line as in the primaries. A deep black spot, bordered outwardly with rich metallic scales and broadly crowned and partially surrounded by rich orange, is placed between the lower median nervules close to the base. Cilia of both wings brown.

Abdomen brown above, paler below ; legs brown ; head brown, eyes white-ringed. Palpi white, with black tips.

♀. Differs only from the ♂ on the upper-side by having a large, black, orange-crowned spot on the hind-wing near the margin, placed between the lower median nervules. On the under-side of the fore-wing there is a minute dot above the subcostal nervure at the end of the chain-like band. The orange-crowned spot on hind-wing is more conspicuous and there are traces of orange scales near the anal angle.

Expanse ♂ 1½ inch, ♀ 1⅝ inch.

Hab. North-west Rhodesia, October and November 1903.

This species, which at first sight appears of a general type, is not very closely allied to any with which I am acquainted.

Hesperiidæ.

Cyclopides cooksoni, sp. nov. (Plate XIII, fig. 10.)

Allied to *Cyclopides formosus*, Butl.* Upper-side blackish-brown with bright yellow spots. Primaries : the basal third and the inner margin thickly dusted with yellow scales. A minute spot about the middle of the costa, and a rather larger one in the cell, below it. An ultra-median band, consisting of various sized irregular spots, reaching from the costa to the inner margin, the spot next to the costal spot

* *Cyclopides formosus*, Butl., P. Z. S., 1893, p. 670, pl. lx, f. 8.

being placed right beyond the band, nearer to the outer margin. Secondaries : a semicircular median band consisting of three large irregular spots, beyond which, is a submarginal row of six (sometimes seven) smaller spots. Cilia of fore-wing black ; of hind-wing black, but bright yellow at apex and anal angle. Under-side. Primaries : costal margin yellow, divided just beyond the cell ; a broad yellow streak and a spot in the cell. The band of irregular spots as on upper-surface is present with the addition of a large spot in the interspace below the costal spot. Yellow marginal internervular radiations and spots as in *C. formosus*, but more pronounced. Secondaries much as in *C. formosus*, but the dark yellow spots deeper in tone and larger.

Antennæ, legs, palpi and head much as in *C. formosus*.

Expanse $1\frac{3}{16}$ inch.

Hab. North-west Rhodesia, December 1903.

One specimen which I take to be a ♀ has a submarginal series of about eight minute yellow dashes on the upper-side of the fore-wing, and on several other specimens I can detect traces of some of these markings.

The hind tibiæ have the two pairs of spurs, the upper pair being smallest.

Mr. Cookson procured a good series of this species, which appears to be quite distinct from any hitherto described.

Explanation of Plate XIII.

Fig. 1. *Mycalesis cooksoni*, sp. n., p. 251.
2. „ *haroldi*, sp. n., p. 252.
3. *Cooksonia trimeni*, sp. n., p. 257.
4. *Erikssonia cooksoni*, sp. n., p. 255.
5. *Liptena homeyeri*, Dewitz, p. 252.
6. *Lycænesthes anadema*, sp. n., p. 258.
7. *Liptena eukrines*, sp. n., p. 253.
8. *Iridopsis euprepes*, sp. n., p. 254.
9. *Spindasis kallimon*, sp. n., p. 254.
10. *Cyclopides cooksoni*, sp. n., p. 260.
11. *Catochrysops pampolis*, sp. n., p. 258.
12. „ *skotios*, sp. n., p. 259.

XV. Pseudacræa poggei *and* Limnas chrysippus; *the numerical proportion of mimic to model.* By Horace A. Byatt, B.A., F.E.S. *With a note* by Professor E. B. Poulton, D.Sc., M.A., F.R.S., etc.

[Read April 5th, 1905.]

Plate XIV.

These butterflies were found among a collection of some 1200 specimens given to me by Père Guillemé of the White Fathers' Mission to Central Africa, under whose direction they were collected at his station at Kayambi, in Awemba country, N.E. Rhodesia, near the sources of the Congo, locally called the Chambezi, between October 1898 and January 1899.

His system was to send out a number of native schoolboys—his "gamins," as he called them—each armed with a net and a book, and orders to capture anything and everything that came in their way, placing their captures between the leaves of the book for safe carrying home.

He particularly mentions that he told his boys to take "des spécimens aussi variés que possible;" and that they would do this literally I know from my own experience of natives, for I have found them generally unable to discriminate between species, and when sent out by me on similar occasions they have returned with large numbers of the insect most in evidence at the moment, and a proportionally smaller number of others. It is, therefore, allowable to suppose that the whole lot which came into my possession gives a very fair idea indeed of the numerical strength of the several species found in the locality.

On opening the papers and examining the specimens—which have suffered a good deal from the damp and neglect of seven years—it was found that roughly one-third of the whole collection consisted of *Limnas chrysippus*, L., and its mimics; and among these latter were seventeen specimens of *Pseudacræa poggei*, Dewitz,—many of them in a fair state of preservation, though, with the rest, they show signs of being unduly pressed between the pages of the book, and are somewhat dulled in colour by damp.

It is due to the suggestion of Professor Poulton that this would be an excellent opportunity to ascertain what numerical relation the *Pseudacræa* bears to its model *chrysippus* that this paper has been hastily prepared in the Hope Department at Oxford before my return to Central Africa.

The country in which Kayambi is situated does not differ greatly from the rest of the plateau to the W. of Lake Nyassa and N.E. Rhodesia. Large stretches of undulating plains, covered with thin scrubby bush or dense tall grass, are intersected at intervals of 5–20 miles by streams and rivers. In the latter months of the year, when these insects were mostly collected, these plains are bare, dry, and dusty, grass and bush being burnt up by the annual bush-fires: and only along the streams is any verdure found. Père Guillemé describes the soil as fertile along the course of the rivers, but elsewhere the district is generally poor and sandy, and for this reason sparsely inhabited, and he remarks on bush-fires being the cause of the general scarcity of insect-life except along the water-courses, where the vegetation is untouched by fires, and where forest-giants, trailing creepers, and tree-ferns flourish.

The altitude of Kayambi is about 3950 ft. above sea-level; and its position roughly 9° 20′ S. and 31° 50′ E., some two days' march from Fife, and three from Abercorn, on the Nyassa-Tanganyika plateau.

The respective numbers and species in the collection were worked out in the Hope Department and are stated in tabular form below:—

SPECIES.	♂	♀	TOTAL.
Limnas chrysippus . .	288	79	367
do. do. var. *dorippus*	8	4	12
Pseudacræa poggei . .	—	—	17
Hypolimnas misippus . .	36	7	45
„ „ ♀ var. *inaria*		2	
Total number in group			441

From this table it will be seen that *Pseudacræa poggei* is by no means so rare as has been hitherto supposed; its proportion to *L. chrysippus* is no less than 4·72 per cent. The *dorippus*, Kl., or *klugii*, Butl., form of *chrysippus*

is found, but in this whole series of seventeen specimens of *poggei* no individual shows any resemblance to *dorippus*: it is purely a mimic of *chrysippus* and shows no approach to dimorphism. This is explainable on the ground that it is found only where *chrysippus* is the largely predominant form, and, so far as is known, it does not occur in, or has not yet reached, the parts where *dorippus* is relatively abundant—that is, the desert strip along the E. Coast, extending in the E. African Protectorate inland at least to the shores of Victoria Nyanza. In this respect it compares in an interesting manner with *misippus* ♀, of which the *inaria* form, mimicking *dorippus*, is found all over Africa (Trans. Ent. Soc. Lond., 1902, pp. 473–484): and also with *Acræa encedon*, L., var. *daira*, G. and S., which is only frequent in localities where its type *dorippus* is predominant (l. c. pp. 473–484).

This occurrence in considerable numbers of what has hitherto been regarded as the rarest species of *Pseudacræa* supports the hypothesis that the mimics of this group are Müllerian rather than Batesian. This has already been argued for *H. misippus* (cf. Rep. Amer. Assoc. Adv. Sci.—Detroit, 1897; and Trans. Ent. Soc. Lond., 1902, pp. 480 and 483, with references) as well as for the genus *Pseudacræa* and for *A. encedon* (pp. 480, etc.). The fact that the latter species, belonging to a protected and much-mimicked subfamily, is far more coincident geographically with the corresponding forms of its model *H. misippus* ♀ is obviously a powerful argument in favour of the Müllerian interpretation.

Note by Professor E. B. Poulton, F.R.S.

It is deeply interesting to compare the details of the mimetic resemblance borne by *Pseudacræa poggei* to *Limnas chrysippus* with those of the other great Nymphaline mimic—*Hypolimnas misippus* ♀. Almost all the points in the following statement can be verified by means of the half-tone reproductions of the three species on the accompanying Plate XIV. It is to be observed, however, that Fig. 1 represents a ♀ *chrysippus* with five wings, a second smaller left hind-wing concealing the central portion of the normal hind-wing of the same side.

As this rare monstrosity was found among the large number of specimens tabulated by Mr. H. A. Byatt it was thought well to select it for representation, inasmuch as the teratological interest is simply an additional advantage which in no way interferes with the bionomic interest of the plate.

The subapical white bar on the fore-wing of *chrysippus* is prolonged downwards and outwards with a slight inward trend by means of a few small marginal spots and a local intensification of the white elements in the fringe. This character is very persistent, and is traceable in the *dorippus* form when the band itself has, except for its costal end, disappeared (compare Fig. 4 with 1). A similar effect is produced in the ♀ *misippus* (Fig. 2) by the position of the last or fifth spot of the band, by a local strengthening of the two rows of whitish hind-marginal lunules, and by the white elements of the fringe. The three narrow interrupted white lines which are thus formed parallel with the hind-margin, persist in the *inaria* form when the band itself is only faintly traceable (compare Fig. 5 with 2). In both *chrysippus* and *misippus* it is obvious, especially in the latter, that this prominent subapical marking is in large part prolonged by the local strengthening or the local persistence of elements which are not part of the bar itself, but belong to the category of marginal markings. In this respect *Pseudacræa poggei* (Fig. 3) stands in considerable contrast with the other two members of the group; for its bar is prolonged—and much more fully prolonged than in the other species—by elements which have the appearance of continuity with the bar itself. If these elements are marginal markings as in *chrysippus* and *misippus* they have been far more subordinated to the subapical bar than in these species. The local strengthening of white elements in the fringe is also somewhat less marked, and plays a less important part in *poggei* than in the others. As regards the few minute spots at the extreme apex of the fore-wing of *chrysippus*, mimetic resemblance is more honoured in the breach by *poggei* than in the too emphasized observance by *misippus* ♀—to say nothing of the very different position of the marking in model and mimic.

In spite of all these differences in detail, the two mimics are by no means unlike; and in general effect

each of them resembles the other more closely than it resembles the model.

The internal contour of the black hind-marginal border of both wings is prolonged inwards along the veins, producing a festooned appearance in *poggei* (Fig. 3) and, to a far smaller degree, in the model (Fig. 1). In the ♀ *misippus* (Fig. 2) this feature is almost wanting. Apart from the contour, the narrow black border of the hind-wings of *poggei* more closely resembles the model than the broader more interrupted and less sharply outlined border of the ♀ *misippus*. At the same time, the two mimics resemble each other in this character more fully than either of them resembles the model, which is widely separated by the row of distinct white spots, which however are very variable, and not infrequently barely traceable. On the under-side of both wings the border of *misippus* (Fig. 2*a*) reproduces the black and white effect of the model (Fig. 1*a*), far better than *poggei* (Fig. 3*a*), in which the white marginal elements are confined to the fringe. On the other hand, in the lighter tint of the veins of the hind-wing under-side and in the colour and texture of the ground-colour, *poggei* is by far the better mimic of the two, while *misippus* is equally superior in the tint of the apical area of the fore-wing under-side beyond the bar. As regards the black discal spots of the hind-wing under-side *poggei* is the closer mimic. The development and shifting outwards of the peripheral spots is an evident special modification, in the direction of the model, of a characteristic feature of the genus *Pseudacræa*. The two small spots nearest to the centre of the wing (see Fig. 3*a*) were only seen in a single specimen out of the seventeen. They indicate the existence of material which may be developed into a still closer likeness to the Danaine model.—E. B. P.

Explanation of Plate XIV.

All the figures are two-thirds of the natural size.

Limnas chrysippus with its two chief mimics, from the sources of the Congo.

Fig. 1. *Limnas chrysippus*, ♀, upper-side. The specimen possesses a second smaller hind-wing on the left side.

1*a*. *Limnas chrysippus*, ♂, under-side.

2. *Hypolimnas misippus*, ♀, upper-side.

2*a*. „ „ ♀, under-side.

3. *Pseudacræa poggei*, upper-side.

3*a*. „ „ under-side.

4. *Limnas chrysippus*, form *dorippus* (*Klugii*), ♂, upper-side.

5. *Hypolimnas misippus*, ♀ form *inaria*, upper-side.

July 15th, 1905.

XVI. *A monograph of the genus* Ogyris. By George T. Bethune-Baker, F.L.S., F.Z.S.

[Read April 5th, 1905.]

Plate XV.

This genus was established and described by Doubleday and Westwood in their Gen. Diurn. Lep. II, p. 472, 1850, where they figured the ♀ of *O. abrota* and used this species int heir description of the family. It is a well-marked genus, and as a consequence later authors have had no difficulty in their descriptions of new species, all having been described under the one genus. Hewitson described and figured his several species in his Exotic Butterflies, vol. I, and his Spec. Cat. Lyc. B. M.; whilst in his Ill. Diurn. Lep. Lycænidæ, he again refers to the group and sinks his *orontas* under his *idmo*. The Felders also use the genus in the descriptions of their two species, whilst all later authors have likewise used it.

The genus is confined to the Australian sub-region, all the species but one being found on that continent (Australia): one species has been recorded from Kangaroo Island as well, whilst one is confined to New Guinea. All the species are beautiful in colour, whilst several rival the *Morphos* in the brilliancy of their blues.

I am indebted to Mr. G. A. Waterhouse of Sydney for very many particulars relative to the life histories of the species and also for the loan of a large number of specimens. Mr. F. P. Dodd has also furnished me with many interesting facts about *O. zosinè*, Hew., and *hewitsoni*, Waterh., whilst Mr. R. E. Turner and Mr. H. H. Druce and Mr. Tepper have kindly lent me specimens of *O. ænone*, Waterh., *O. barnardi*, Miskin, and *O. halmaturia* Tepper.

The ova are either nearly spherical, or somewhat compressed at each end of the axis, whilst some are strongly reticulated. The larvæ, so far as is yet known, are all

Loranthus feeders, and all feed either at dusk or at night all are attended by ants of various species, some apparently by different species in different neighbourhoods, whilst Mr. Dodd informs me that *O. zosine* (♀ *genoveva*) is attended by two species of *Camponotus* and also by the small black ant. He adds also that both it, *orates*, Hew., and *hewitsoni*, Waterhouse, emit sounds when in the pupa state and when accompanied by ants; if however the ants are taken away the pupæ remain silent—whilst if a pupa be found unattended by ants, it is an almost certain indication that it is dead; the sound is described as a distinct ticking, occasionally accompanied by a soft humming. The pupæ, of which I have several before me, are of the usual Lycænid shape, and are found under stones or under loose bark, fastened at the anal extremity and supported by a girdle of silk around the middle, and generally assimilating in colour with their surroundings.

The species of the parasitic genus *Loranthus*, on which the larvæ feed, generally grow high up on the tallest trees, and as a consequence the perfect insect flies high and is a strong flier; this fact possibly accounts for the scarcity of the group in collections generally. The species are probably on the increase, as Mr. Waterhouse informs me that he now breeds *ianthis* in a spot over which during his younger days he collected for years, and of which he knew every inch of the ground, and during this time he never saw a single specimen of this genus; this is however what might be expected, for it appears quite certain that the larvæ and pupæ are protected by the ants, in which case they would be immune from a certain class of enemies, and we might therefore look for the various species to increase in numbers.

The various species form themselves into two obvious sections, the females of which have a pale spot in the primaries, or are without that spot; and in like manner they fall into sub-sections also; the whole being closely verified by the form of the genitalia of the males, descriptions of which I append in the form of a table, though in a few species that have been lent me I am unable to do this.

The tegumen of the whole of the *Lycænidæ* is furnished with a pair of hooks at the lower extremities of the lateral lobes, these I have designated by the term "Falces" (*falx*, a reaping-hook).

Key.

A. Upper-side generally purple; ♀ with pale spot on the primaries.

a. Sexes nearly the same colour.

a 1. Termen broadly brown, strongly arched . . . . . *waterhouseri.*

a 2. Termen quite narrow, nearly straight . . . . . *idmo.*

a 3. Smaller, lighter purple, termen narrowly brown, pattern of secondaries beneath nearly obsolete . . . . . *otanes.*

a 4. Like 3, but termen broadly brown, broader at apex and tornus . . . . . *halmaturia*

b. Sexes dissimilar in colour.

b 1. Dull brownish-purple, termen broadly brown at apex tapering to tornus, anal angle of secondaries produced into a short broad tail . . . . . *genoveva.*

b 2. Brighter purple, termen nearly uniform in width . . . . *genoveva-duaringa.*

b 3. Rich purple, larger in size with very large females . . . . *genoveva-magna.*

b 4. Very dark velvety-purple (almost brown) with long tail, slightly spatulate, pattern below strongly spotted, no metallic markings in the cell of primaries . . . *meeki.*

b 5. Smaller, very deep velvety-blue, termen black very broad, pale large subovate lemon spot in primaries . . . . . *abrota.*

b 6. Brilliant metallic-blue with broad black costa and termen; ♀ primaries bright orange, with broad borders . . . . . *ianthis.*

B. ♀ without a pale spot on the primaries.

a. ♀ with no red spot beneath in the primaries.

b. Both sexes dark purple.

a 1. Purple area very small, nearly the same in both sexes . . . *olane.*

a 2. Purple area brighter extending up to termen in ♂ . . . . *barnardi.*

c. Both sexes brilliant metallic-blue.

a 1. Discal band of primaries beneath not fractured . . . . . *orœtes.*

d. Brilliant metallic-blue; ♀ with red in the primaries beneath.

a 1. Discal band of primaries beneath fractured . . . . . *hewitsoni.*

a 2. Smaller, deeper blue, with pale metallic-blue spots in cell beneath . . . . . *hewitsoni-meridionalis.*

a 3. Primaries with very broad black apex and termen, and very dark under-surface . . . . *amaryllis.*

a 4. Brilliant silvery-blue with costa and apex broadly black, beneath very pale grey, with pattern small and isolated . *ænone.*

See Tables, pages 290, 291.

Ogyris, Doubleday, Westwood and Hewitson.

Ogyris, D. W. and H., Gen. Diurn., Lep. II, p. 472 (1850–1852).

Primaries broad, with costa slightly arched; apex subacute, sometimes produced; termen sometimes slightly excavated below the apex, or nearly straight, or slightly convex; inner margin straight. *Neuration*, vein 1 waved, vein 2 arising beyond the middle of the cell, 3 from nearer the lower angle of cell than from 2, 4 from the lower angle, 5 from above the middle of the discocellulars, 6 from the upper angle, 7 absent, 8 from directly behind the upper angle of the cell, 9 from about midway between the end of the cell and the apex of the wing, or from nearer the apex, 10 and 11 with bases

equi-distant from each other and the upper angle of cell, 11 short, 12 short never as long as the cell. Secondaries broad, sometimes with a short broad spatulate tail at the end of vein 2, sometimes with a short tail at end of vein 1 b, or with termen crenulate—♀ sometimes with a short tail at the end of vein 4, with two internal veins—vein 2 rising from just below the middle of the cell, 3 from near the lower angle, 4 from the lower angle, 5 from the middle of the discocellulars, 6 from the upper angle of cell. Palpi curved, with middle segment long, end segment very short and slightly deflexed.

The genus was created for the reception of two species *O. abrota*, D. W. and H., and *O. idmo*, Hew., the diagnosis being evidently made from the former species. It is nearly related both in structure and pattern of wings to the genus *Arhopala*, Feld.; both genera are arboreal, rarely coming down to the ground, and when disturbed from their resting place, they will frequently return to it after the lapse of a little time; this, however, is a habit well known to occur in other genera also.

Ogyris Waterhouseri, spec. nov.

♂. Both wings very dull brownish-purple, almost greasy looking. Primaries with a broad even brown costa and a broad termen likewise of even width. Secondaries with a broad dark brown costa, and a broad brown termen of uniform width. Fringes white broadly intersected with brown at the veins. Under-side. Primaries brown, with three increasing cell spots, the first two divided by an obscure bluish-white line, beyond the third a short broad oblique pale grey stripe, beyond which is the catenulated, very irregular, dark brown stripe, slightly curved extending from the costa to very near the termen at vein 2; the apical area up to this stripe is densely irrorated with whitish-grey fine scales. Secondaries, brown, finely irrorated with brownish-grey, the three basal spots are confluent, in the median row of three spots the two upper ones touch, the second occupying the central part of the cell is large, the third on the inner margin is isolated, the third row is very irregular, first spot on the costa subreniform, the second spot very large, touching the exterior edge of spot 1, <-shaped on its exterior margin, a large spot beyond the cell touching the inner edge of spot 2, the fourth spot angled with the third and receding inwards, the fifth spot again angled internally confluent with spot 4, the posterior row of four spots touches the exterior edge of the second large spot in the

previous row, and each spot is angled externally but is rounded internally, the upper three touch each other, the fourth being isolated on the inner margin, the subterminal row is obscure consisting of little more than an indefinite stripe.

♀. Both wings brightish-purple with a blackish spot at the end of the cell, that on the primaries being much larger than the one on the secondaries. Primaries with a broad brown costa and termen and a small (comparatively) lemon-coloured spot beyond the black spot terminating the cell; secondaries with a very broad brown costa and a broad brown somewhat irregular termen. Underside primaries as in the male, but the divisions between the cell spots are pale blue and the lemon spot shows through. Secondaries as in the male but greyer, the pattern therefore shows more distinctly and the spots in the median area are more confluent.

Expanse ♂ 53, ♀ 52–53 mm.

Hab. Victoria.

This species is distinct from *O. idmo*, Hew., to which it is very nearly allied, the shape of the wings in the ♂ is quite different, the costa of the primaries is more curved, and the termen is distinctly produced outwards between veins 2 and 5; in *idmo* the termen is nearly straight, receding from near the apex to the tornus, the shape and width of the brown costa and termen are very different, and below the posterior catenulated stripe is different in position and shape whilst the under-side of the secondaries differs considerably in pattern also.

Ogyris idmo, Hew.

O. idmo, Hew. Cat. Lyc. B. M., p. 2, pl. I, figs. 3, 4, 1862. Ill. Diurn. Lep. Lyc., p. 2, 1863; *id.* Kirby, Cat. D. L., p. 425, 1871; *id.* Semper, Journ. Mus. God., p. 55, Heft 14, 1878; *id.* Miskin. Proc. Lin. Soc. N.S.W., p. 24, 1890; *id. idem.* Ann. Queensl. Mus., p. 72, 1891; *id.* And. and Spry. Vict. Butt., p. 104, 1894; *id.* Waterhouse, P. L. S., N.S.W., p. 248, 1903; *id. idem.* Mem., N.S.W. Nat. Club, p. 29, 1903; *O. orontas*, Hew., Cat. Lyc., B. M., p. 2, pl. I, figs. 8 and 9, 1862.

♂. Both wings dull brownish-purple or purplish-brown, in certain lights the purple has an almost red lustre. Primaries with a very narrow almost linear-brown termen. Secondaries with costa brown to vein 7, termen very narrowly brown. Under-side, both wings brown finely irrorated with pale grey. Primaries with three

increasing cell spots, edged with pale blue or blue and white lines; beyond the third spot, which is very large, is a broad fascia of greyish-white scales, followed by the posterior catenulated stripe from the costa to vein 1, the spots on the costa being large and tapering rapidly to the third spot, the least trace of a subterminal line. Secondaries more thickly covered with pale grey irrorations, the basal spots are obscure and only indicated by the very fine darker encircling lines, the median row of three spots irregular that in the cell very obscure; the third series of spots is very confluent, the one on the costa being isolated and the rest all confluent; the posterior row of four or five spots is irregular and fractured, the first and second below vein 6 being confluent and touching the previous series, together they form a reniform spot, spots 3 and 4 are projected outwards, detached from 1 and 2, but touching each other, spot 5 shifted inwards and isolated.

♀. Both wings brown with a dull purplish lustre over a portion of the wings. Primaries with the purplish lustre over half the cell and extending broadly for two-thirds of the inner margin, a dark large spot at the end of the cell followed by a larger lemon cream-coloured spot. Secondaries with the purplish lustre over three-fourths of the wing leaving merely a very broad brown border to the costa and termen. Under-surface similar to the male but in the primaries the pale cream spot shows through, and in the secondaries the pattern is much more distinct.

Expanse ♂ 52–57, ♀ 57–60 mm.

The distribution of this species issomewhat uncertain, but I believe that it is confined to Western Australia, and that the species found in South Australia and Victoria will all prove to be *halmaturia* and *waterhouseri*, B. B. I have seen no true *idmo* from either of these localities. I have before me now Hewitson's type specimen of *orontas* and it is identical with *idmo*. I have pointed out the differences between these species, and I would further state that I regard Tepper's species as distinct from *otanes*, Feld., both of which types are now before me.

Ogyris otanes, Feld.

Ogyris otanes, Felder Reise. Nov. Lep. II, p. 217, taf. 28, fig. 1–3, 1865; *id.* Kirby, Cat. D. L., p. 425, 1871; *id.* Semper, Journ. Mus. God. p. 55, Heft 14. 1878; *id.* Miskin. P. L. S., N.S.W., Ser. 2, V, p. 23, 1890; *id. idem.* Ann. Queensl. Mus. No. 1, p. 71, 1891; *id.* Waterh. (in parte)

P. L. S., N. S. W., p. 249, 1903; *id. idem.* Mem. N.S.W. Nat. Club, No. 1, p. 29, 1903.

♂. Both wings dull reddish brown purple, primaries with the brown termen narrow straight and of uniform width. Secondaries with the costa and apical area very broadly brown, the latter tapering into the wide brown termen, the tail at the tornus is somewhat developed, but not sufficiently as to be called a tail. Under-side. Both wings pale brownish, primaries with two obscure spots in the cell, finely divided by bluish white lines, followed by a large blackish patch with an irregular pale bluish pupil. The posterior catenulated stripe is composed of five irregular dark spots palely edged, followed by an obscure trace of a sixth shifted inwards. There is no trace of any subterminal or terminal line. Secondaries with pattern very obscure, the basal series of spots is barely discernible, in the median series the costal spot is very large, that in the cell much smaller and irregular, that on the inner margin smaller still, the series at the end of the cell is confluent irregular extending from the costa to the inner margin, the second spot (from the costa) being very large and touching the posterior series which is composed of a pair of confluent spots followed by a second pair of confluent spots shifted outwards, beyond which is an isolated spot shifted well inwards.

♀. Both wings brighter purplish, primaries with the wing beyond the cell and above vein 3 brown. A darker patch at the end of the cell followed by a pale lemon-coloured smallish patch. Secondaries with the costa above vein 6 brown and a broad brown termen. Under-side like the male but irrorated with grey so that the pattern is more distinct and the pale spot shows through in the primaries.

Expanse ♂ 45, ♀ 48 mm.

Through the kindness of Mr. Rothschild I have Felder's types before me and am therefore enabled to compare them with specimens sent me from South Australia.

The shape of the insect is that obtaining in *idmo*, Hew., the apex of the primaries being somewhat acute and the termen straight; the colour also is nearest to that species, but is paler and somewhat brighter, it is however smaller and the under-side pattern is quite diverse. Mr. Waterhouse has kindly sent me for examination two specimens from Kangaroo Island with a query as to whether they are Felder's insect, but after a very careful comparison I believe them to be distinct, and they are the form named by Tepper *halmaturia*. I have now before me the type of this species as well as Felder's type (I must here express

my best thanks to Mr. Tepper for the loan of it), and I consider that they are distinct forms; more material may prove them to be sub-species, but they differ sufficiently to warrant them being named. The locality for *otanes* will therefore be South Australia only.

Ogyris halmaturia, Tepper.

O. halmaturia, Tepper Com. Ins. S. Aust. II, p. 12, 1890. *O. otanes*, Feld., Waterh., P. L. S., N.S.W., p. 249, 1903 (part); *id. idem.* (part) Mem. N.S.W. Nat. Club, p. 29, No. 1.

♂. Both wings brighter purplish. Primaries with the termen broadly brown, broadest at the apex and tornus, the purplish area terminating in an even curve from the costa to the inner margin. Secondaries with the purple area almost confined to the cell and about two-thirds beyond it. Under-surface like *otanes*, Feld., but much greyer. In the primaries the catenulated posterior stripe is curved, not straight as in Felder's species. In the secondaries the pattern is more obscure and there is a broadish indefinite band of darker shading outside the posterior stripe which is more marked in the female than in the male.

♀. Like the male in all respects except that the colour is brighter and there is the pale spot on the primaries.

Expanse ♂ 46, ♀ 50 mm.

The types from Kangaroo Island are in the S. Australian Museum. Mr. Waterhouse also has specimens from the same locality.

This species may be distinguished from *otanes*, Feld., by the marked arched and broad termen to the primaries, by the broad brown termen in the secondaries, and by the shape of the wings, the termen being arched and the apex rounded.

It is very desirable that a trip should be made to Kangaroo Island and also to the localities in South Australia from Cape Willoughby to the south-west corner.

The species frequents broken country, thinly studded with *Melaleuca* shrubs, between which, Mr. Tepper tells me, they sailed in couples but were very wary and difficult to approach. It is however much to be wished that a good series of both these closely-allied species could be obtained, so that we could see whether the distinctions are constant.

Ogyris meeki, Roths.

O. meeki, Roths. Nov. Zool. VII, p. 274, pl. V, fig. 1, 1900.

The female of this species is as yet unknown; we may expect it to have three tails and to have a pale spot on the primaries; the male is the largest of the genus and the only species that has fully developed tails; the outline of wings is different to all others inasmuch as the costa of the primaries is more strongly arched and the apex produced, with the termen slightly excavated below it, thus giving it a very distinctive appearance from the rest of its allies; it may also be recognized by the uniform deep purplish tone of its upper-side which is quite different from the colour of any other species of the genus.

Ogyris zosine, Hew.

O. zosine, Hew., Exot. Butt., I, pl. I, figs. 3, 4, ♂, 1853. *id.* Kirby, Cat. D. L., p. 423 (1871). *id.* Semper, Journ. Mus. Godef. Heft 14, p. 55, 1878. *id.* Hew., Cat. Lyc. B. M., pl. I, fig. 7, ♂ (nec ♀), 1862. *id. idem.* Ill. Diurn. Lep., p. 2, 1863. *id.* Miskin, Ann. Queensl. Mus., No. 1, p. 71, 1891. *O. genoveva*, Hew., Exot. Butt. I, pl. I, figs. 5, 6, ♀, 1853. *id.* Semper, Journ. Mus. Godef. Heft 14, p. 55, 1878. *id.* Hew., Cat. Lyc., B. M., p. 3, 1862. *id.* Ill. Diurn. Lep., p. 2, 1863. *id.* Staud., Exot. Schmett. taf 96, 1888. *id.* Miskin, P. L. S., N. S. W., p. 23, 1890. *id.* Miskin, Ann. Queensl. Mus., No. 1, p. 71, 1891. *id.* Waterh., P. L. S., N. S. W., p. 245, 1903. *id. idem.* Mem. N. S. W. Nat. Club, p. 29, 1903.

This species is probably the best known of the genus, and is apparently becoming a dominant species; there are already three distinct local races in different parts of the country, that in the south being the brightest of all, whilst the type form obtaining in Townsville and its neighbourhood is the most sombre in colouring.

It has hitherto been known in all collections with which I am acquainted as *O. genoveva*, Hew. It is difficult to discover how this has arisen, because Hewitson described *zosine* (l. c.) previously, and also figured it previously on the same plate. It is perhaps commoner in Queensland than elsewhere. The ♀ is dimorphic. I have therefore retained the name *genoveva* for the pale blue ♀ as described

by Hewitson. There are however two other easily recognizable forms obtaining in other localities in Australia, the one from Coomooboolaroo, N. Queensland, and the other from Brisbane; these appear to be good constant local races, so I have no hesitation in naming them. Mr. Waterhouse tells me that he has taken this species feeding on *Loranthus linophyllus*, Feu., at the Richmond River, and on *L. celastroides*, Sieb., at Sydney. The egg is plain, spherical, flattened at the top, and is usually laid on the mistletoe stem near its origin with its host. The young larvæ are uniformly light brown (F. P. Dodd), and subonisciform; when full grown, however, they become less woodlouse-like, as they then measure from 25 to 32 mm., but when in motion they are considerably longer; in colour they are dirty cream colour to ochreous yellow above, and purplish below, with black spiracles, this being the form that is found in North Queensland; those found in the South however differ, and are, according to Waterhouse, brownish-red above and yellowish below. They hide in the cracks of the bark of the host tree or in holes in the mistletoe during the day, or beneath the surface of the earth, coming out at dusk and feeding at night, at which time I am informed the ants associated with them are likewise on the move; the species of ants that Dodd has found them with most commonly is *Æcophylla virescens*, but several other species also associate with them. They evidently protect the larvæ, and have been observed to milk them; in one instance an ant was observed to approach a larva and wave its antennæ over its terminal segments, and then to lightly touch it with its fore-leg, when a small globule of liquid was emitted from a small retractible nipple-like organ on the dorsum which was at once sucked up by the ant. The process was then repeated on the other side, there being two of these organs, one on each side of the dorsum; this happened two or three times, and the larva seemed quite composed and in no way incommoded by the incident. I possess larvæ in spirit both from Queensland and from Sydney, and the form from Sydney is darker and more highly coloured than that from the North. The pupa, some of which I have before me, is very dark brown, almost blackish, of the usual Lycænid form; it attaches itself by its terminal segments to the under-side of stones or loose bark and spins a girdle of silk across its back about the end of the wing cases and

so undergoes its transformation, and is quite undisturbed and unmolested by its ant hosts.

Mr. Waterhouse tells me that the form found at the Richmond River (N.S.W.) is distinctly smaller than that found both to the North and to the South of that locality, he says also that he never sees males on the wing until about 2 p.m. in the day, when they fly high (about thirty feet) around the *Eucalyptus* trees, and are very difficult to catch; the females are very rarely seen on the wing.

This year the species has been recorded from South Australia, Mr. Lyell having recorded it in the Victorian Naturalist, vol. xxi, p. 166 and 167; from Dimboola, larvæ and pupæ were taken in November and December last, the perfect insect emerging in the latter month. Mr. Lyell and his friend Mr. Fricot were hunting for the larvæ of *O. idmo*, but instead of finding it they discovered caterpillars of this species; they confirm the observation that it feeds by night, and they also state that it pupates at the foot of the tree below the surface of the ground. In order to test the action of the attendant ants one or two larvæ were placed a couple of feet or so away from the tree; they were however soon discovered and dragged carefully back to the tree by the ants at a pace much more rapid than their own rate; pupæ were likewise carried back to the tree.

Ogyris zosine-duaringa, sub spec. nov.

Ogyris genovera, Miskin, Trans. Ent. Soc. Lond., p. 343, pl. xv.

♂. Both wings brightish purple. Primaries with a broad darker but equally bright suffusion across the median area of the wing, the brown termen is much narrower than in *zosine* and of equal width from the apex to the tornus. Secondaries with a very narrow brown termen, little more than linear. Under-side as in the type but with the spots more distinctly outlined and with a velvety clouding near the tail at vein 4.

♀. Similar to the female of the form *genovera*, Hew., but the blue instead of cærulean is brilliant greenish-blue much more lustrous than in Hewitson's insect.

Expanse ♂ 54–58, ♀ 56–58 mm.

This subspecies was taken by Meek at Coomooboolaroo, where it appears to be a constant race; there is a long

series of it in the Tring Museum; it is also the form figured by Miskin (l. c.).

Ogyris zosine-magna, sub spec. nov.

♂. Both wings rich purplish-blue. Primaries with the apical third of the costa and the apical half of the termen hoary. Secondaries dark brown to vein 6. Tail at vein 4 not developed, the scallop being but little longer than that at the end of veins 3 and 5.

Fringes white, interrupted at the veins, antennæ bright chestnut, very finely dark on the upper-side, the club being bright orange chestnut. Under-side as type species but darker grey.

♀. Both wings velvety black. Primaries with the basal area to about half the cell and half the inner margin brilliant silvery lustrous greenish-blue more greenish than in *duaringa*, and with the usual pale spot. Secondaries with the silvery lustrous greenish area more reduced extending only to just beyond the cell and tapering in an arc to three-fifths of vein 2. Veins 2 and 4 are developed into strong broad tails, and vein 3 into a prominent tooth, at each of the latter is a lustrous greenish blue spot. Under-side similar to the type species but more strongly marked.

Expanse ♂ 66, ♀ 70 mm.

The types are from Brisbane, and are in my collection. Mr. Waterhouse also has it from the same locality.

Ogyris abrota, Doub. and Hew.

Ogyris abrota, Doubleday and Hew., Gen. Diurn. Lep., pl. 75, fig. 8 ♀, 1850; *id.* Hew. Exot. Butt. I, pl. I, figs. 1 and 2 ♂, 1853; *id. idem.* Cat. Lyc., B. M., p. 2, 1862; *id. idem.* Ill. Diurn. Lep. Lyc., p. 2, 1863; *id.* Kirby, Cat. D. L., p. 425, 1871; *id.* Semper, Journ. Mus. Godef., Heft 14, p. 55, 1878; *id.* Miskin, P. L. S., N.S.W., p. 25, 1890; *id. idem.* Ann. Queens. Mus., No. 1, p. 72, 1891; *id.* And. and Spry., Vict. Butt., p. 109, 1894; *id.* Waterh., P. L. S., N.S.W., p. 247, 1903; *id. idem.* Mem. N.S.W. Nat. Club, p. 28, 1903. *O. damo*, Doubld. List. Lep., B. M., pt. 2, p. 20.

This species is recorded from Victoria, New South Wales and South Queensland. Anderson and Spry have described its metamorphosis, they say that the ova are dull white and quite globular and are laid on the inside of loose bark by

the food plant or upon its stems. The larvæ feed chiefly upon *Loranthus pendulus*, and are onisciform, broadened and flattened at the anal segments and with a dorsal ridge; the general colour is dark fulvous paler along the ridge with a series of oblique (? lateral) stripes; on the tenth segment is a black irregular diamond-shaped patch pupilled with greyish-white, the last segment having a dark T-shaped mark, the spiracles are white encircled with black, the surface generally being rugose and punctated with minute bristles, with a subspiracular series of short bristles. The larval state is said to last for some months and to be delicate and difficult to rear; ants are always with them, and whilst they appear to be free from attacks of insect parasites, a fungoid disease at times kills large numbers of them. When full grown the larva measures from 20 to 25 mm.

Ogyris ianthis, Waterhouse.

O. ianthis, Waterhouse, P. L. S., N.S.W., pp. 52–54, pl. I, figs. 1–4, 1900; *id. idem.* p. 341, 1902; *id.* p. 247, 1903; Mem. N.S.W. Nat. Club, No. 1, p. 29, 1903.

This species can readily be recognized from Waterhouse's description and from its rich orange-chrome-coloured female; it is apparently confined to the neighbourhood of Sydney. The ova are pale pinkish in colour, in shape they are flattened somewhat at the top, and reticulated all over. The larva, which hides at some depth in ants' nests during the day, does not move until night, and feeds on *Loranthus celastroides* in the dark, always making for a dark corner should a light be turned on it; it is pinkish-brown with a much darker dorsal line and paler lateral bands, one on each segment; the under-side is pale cream colour. The pupa is reddish-brown of the usual shape. I find that the organs on the last segment but one through which the fluid so greedily sucked by ants is passed are very marked in this species. I have a young larva in formalin now in front of me, and I notice that these organs (a pair) are situated on each side of the dorsum, and consist of a prominent tubercle shagreened all over, with a deep orifice in the centre from which the retractile tube is everted or withdrawn at will; when at rest the tube is contracted, and is apparently only emitted when the larva is induced to do so.

Ogyris olane, Hew.

Ogyris olane, Hew., Cat. Lyc., B. M., p. 2, pl. I, figs. 10, 11, 1862; *id.* Ill. Diurn. Lep., p. 2, 1863; *id.* Miskin, P. L. S., N.S.W., p. 27, 1890; *id.* Kirby, Cat. D. L., p. 425, 1871; *id.* Semper, Journ. Mus. God., Heft 14, p. 55, 1878; *id.* Miskin, Ann. Queensl. Mus., No. 1, p. 72, 1891; *O. catharina*, Feld. Reise, Nov. Lep. II, p. 218, 1865.

♂. Both wings darkish-brown. Primaries with a patch of dull brownish-purple occupying the area between the median and submedian veins extending slightly into the cell and one-third the space beyond below vein 2. Apical area and half down the termen paler brown. Secondaries with the purple occupying the cell and one-third the space beyond, termen strongly crenulate.

Fringes white interrupted at the veins.

Under-side primaries dark brown with the cell spots defined by five pale metallic-blue lines, a dark irregular oblique line midway between the cell and the apex, beyond which the wing is suffused with whitish-grey scales, an obscure subterminal band tapering towards the apex extending into the grey area. Secondaries grey darker towards the inner marginal and tornal area, spots slightly darker defined by fine dark lines. Basal spots small, median series large, the first below the costa narrow touching the large spot across the cell which is confluent with the one below it, an isolated long oblique spot from the costa to the large cell spot just mentioned, third series, with the first and second spots confluent, the first strongly oblique, the second an inverted ∧-shape confluent with the two smaller spots below it, posterior series from vein 6, the second and third spots confluent shifted outwards, the fourth still outwards and slightly darker, fifth and sixth smaller and shifted inwards, a trace of a subterminal dark irregular line, lower terminal area darkly suffused.

♀. Like the male but with the purple area very slightly less in extent, whilst the secondaries on the under-side have the spots larger and darker thus forming a strong contrast with the grey ground-colour.

Expanse: ♂ 42–44, ♀ 44–49 mm.

Hab. S. Australia, Victoria and N. S. Wales.

This description is of the form now found in Australia; it does not agree with the colour on the upper-side of Hewitson's type, which is paler and bright blue, the under-

side agrees, however, fairly closely. I have no doubt that the two insects are the same species, but that Hewitson's type may have undergone some change (possibly chemical) which has effected the difference in colour. In my study of the genus *Arhopala* I became convinced that the blues of that genus, hitherto considered so very constant and unchangeable in colour, are liable to alteration, this being especially so where the colours are apparently aniline, and further experience tends to confirm that opinion, though I am not prepared to say in what manner the change of tone is effected, but it apparently does not affect the scales themselves.

Anderson and Spry describe the ova as of a pearly lustre and flattened at the poles; they are laid on the edges of loose bark, or on the stems of *Loranthus pendulus* and sometimes on the galls which furnish hiding-places for the larvæ; these closely resemble the larvæ of *O. abrota*, Hew., but have a small black patch on the anal plate; they are at times great wanderers, and are strictly nocturnal feeders and have to travel long distances from their hiding-places to their food, which in the summer months is often scarce, as the *Loranthus* loses most of its leaves then; they appear to be able however to withstand prolonged abstinence and yet to undergo safely their metamorphoses, in these cases however the imagines are of course smaller than usual. The larvæ are also greatly subject to parasites, their worst enemies being two species of Diptera, one of which lays its eggs in its host, whilst in the case of the other fly, apparently the larvæ is not a parasite, but is furnished with pointed mandibles and is said to suck its victims dry. This dipterous caterpillar being very active and voracious works serious destruction amongst the larvæ of *olane*. The pupa is somewhat delicate and suffers from the rays of the sun if in too exposed a situation; it remains about a month in this state before emerging as the perfect insect.

Isolated specimens may be caught throughout the year, but October and November, and February and March are, according to Anderson and Spry, the months when they usually fly, though it is difficult to take, owing to its habit of flying around the topmost branches of the gum trees.

Mr. Spry informs me that he has never once seen this caterpillar attended by ants, though he has studied it and known it for years, the fact also that it is subject to the attacks of parasites no doubt corroborates his observations.

Ogyris barnardi, Miskin.

Ogyris barnardi, Miskin, Proc. Linn. Soc. N.S.W., p. 27, 1890; *id. idem.* Ann. Queensl. Mus., No. 1, p. 72, 1891; *id.* Waterhouse, *idem.* p. 248, 1903; *id.* Waterhouse, Mem. N.S.W. Nat. Club, p. 28, 1903.

♂. Both wings dull purple. Primaries with termen narrowly brown, slightly broader at the apex. Secondaries with costa somewhat broadly brown and very narrow brown termen; termen very slightly crenulate. Under-side like *olane*, Hew., but the primaries are paler brown, and in the secondaries the spots are smaller and there is no dark suffusion.

Expanse ♂ 41–45.

Dawson River, Peak Downs (Queensland).

Ogyris orœtes, Hew.

O. orœtes, Hew., Cat. Lyc., B. M., p. 3, pl. I, figs. 12 and 13, ♀, 1862; *id. idem.* Ill. Diurn. Lep., p. 2, 1863; *id.* Kirby, Cat. D. L., p. 425, 1871; *id.* Miskin, P. L. S., N.S.W., p. 25, 1890; *id. idem.* Ann. Queensl. Mus., I, p. 71, 1891; *id.* Waterh. P. L. S., N.S.W., p. 335, pl. XIV, figs. 1 and 2, 1902; *id. idem.* p. 246, 1903; *id. idem.* Mem. N.S.W. Nat. Club, I, p. 29.

The only locality of which we are certain at the present time is Queensland. Mr. Waterhouse informs me that the specimens mentioned by Miskin (l. c.) from W. Australia and Victoria are *hewitsoni*, whilst the ♀ in the Australian Museum is a ♂ *amaryllis*. Dodd has bred the species plentifully, and he tells me that the full-grown larvæ are light yellowish-brown faintly tinged with green, and that he has always found them among or close to communities of ants. The pupæ are dark brown, and are of the usual shape; I have specimens now before me, but there is nothing worthy of note in them. Dodd says they "tick" in the same way as *genoveva*, only decidedly more slowly and not so loudly.

Ogyris hewitsoni, Waterh.

O. hewitsoni, Waterh., Proc. Linn. Soc. N.S.W., p. 338, pl. XIV, f. 5–8, 1902; *id. idem.* p. 246, 1903; *id. idem.* Mem. N.S.W. Nat. Club, p. 29, 1903; *O. amaryllis*, And. and Spry, p. 102, 1894.

The female of this insect is unrecognizable on the upper-side from the ♀ of the *orœtes*, except that in the present species the brilliant blue extends over the upper margin of the cell, whilst in Hewitson's species it does not. Under-side, like the male, except that the pattern is generally more distinct and isolated. In the cell of the primaries are two large vermilion red spots edged on each side with pale metallic bluish, and with traces of red further along the cell.

This species seems to be the commonest of all the genus with the exception possibly of *genoveva*. It has been recorded from all the Australian States except Tasmania. I am again indebted to that careful observer, F. P. Dodd, for information as to the life history. He finds the larvæ in the same localities as *orœtes* always among or near ants; when full fed they are grey or greyish-brown, and are duller in colour than the other species he has taken; the pupæ emit similar sounds, and like the preceding insect "tick" more slowly than *genoveva*. These sounds are not continued for any length of time, but a gentle touch or a shake will generally set them going again, and when one specimen begins others in the vicinity as a rule follow its example. Mr. Dodd tells me that each of the three caterpillars of this genus that he is acquainted with feed at night only.

Ogyris hewitsoni-meridionalis, sub spec. nov.

♂. Both wings with the blue decidedly deeper and less silvery in tone. Under-side altogether darker, the cell markings larger and the white edgings tinged with blue. Secondaries browner, with none of the strong contrasts that are so conspicuous in *hewitsoni*; the spots are browner and not so broken up as in Waterhouse's type race.

♀. Both wings with the blue of a lilac lustre, not silvery. Under-side similar to the type form.

Expanse ♂ 40–41, ♀ 42 mm.

The Southern form from Victoria is very decidedly less brilliant than Waterhouse's species, it is also much smaller. I have it from several localities, and as Mr. Waterhouse says that these differences are constant, it seems to be advisable to name the local race.

Ogyris amaryllis, Hew.

O. amaryllis Hew., Cat. Lyc., B. M., p. 3, pl. I, f. 5 and 6, ♀, 1862 ; *id. idem.* Ill. Diurn. Lep., p. 2, 1863 ; *id.* Kirby, Cat. D. L., p. 425, 1871 ; *id.* Miskin, P. L. S., N.S.W., p. 26, 1890 ; *id. idem.* Ann. Queensl. Mus., p. 72, 1891 ; *id.* Waterh., P. L. S., N.S.W., p. 336, pl. XIV, f. 3, 4, 1902 ; *id. idem.* Mem. N.S.W. Nat. Club, p. 29, 1903.

This species can easily be recognized from its predecessor by the very broad borders to the primaries and by the deeper tone of blue in both wings.

The range of the species appears to be restricted to the neighbourhood of Brisbane (S. Queensland) and the Richmond River in New South Wales, from which latter locality Waterhouse has bred it. The ova are pinkish grey, somewhat flattened with raised reticulations, and are laid on the mistletoe knobs. The larvæ feed on *Loranthus linophyllus*, and when young are greenish, but later they become dark grey assimilating very closely with the host-plant of the *Loranthus*.

Ogyris ænone, Waterhouse.

O. ænone, Waterh. P. L. S., N.S.W., p. 339. pl. XIV, fig. 9 ♂, 1902 ; *id. idem.* p. 246, 1903 ; *id. idem.* Mem. N.S.W. Nat. Club, p. 29, 1903.

♂. Both wings brilliant lustrous morpho-blue, more brilliant and lustrous than in any other of the genus, in certain side lights having a metallic mauve lustre. Primaries with the costa broadly blackish increasing at the apex, termen narrowly blackish increasing rapidly towards the apex, and decreasing slightly towards the tornus. Secondaries with the costa broadly dark greyish and termen very finely black. Under-side. Both wings pale whitish dove-grey. Primaries with three increasing cell spots palely edged, the basal spot pale brownish, the second and third deep black with bluish white margins ; below each of these latter a black spot, catenulated stripe very irregular consisting of seven spots, the first two below the costa quite pale, the third blackish and small, fourth slightly larger shifted outwards, fifth shifted inwards, sixth very large and ovate inclined outwards, seventh oval rather smaller shifted and inclined inwards, a trace of a subterminal line. Secondaries rather darker than the primaries with three basal spots, the first and third very small median series widely isolated, a small darkish spot below the costal

vein, a larger pale grey spot on the inner margin of the cell with two small spots below it (one on each side) followed by another pale spot on the inner margin, third series very irregular, a longish narrow spot below the costal vein, a pale round one in the angle of vein 7, a large irregular one closing the cell below which is an indefinite trace of a fourth followed by a larger and more distinct spot on the inner margin, posterior catenulated series, irregular and somewhat indefinite on its inner margin, the first spot large below vein 7, second and third shifted right outwards, fourth and fifth well inwards, sixth spot obscure, shifted inwards, an indefinite subterminal slightly dentate stripe, a trace of a brownish spot on the slightly developed lobe at the tornus.

♀. Both wings less lustrous and not quite so pale a blue as the male with broader margins. Primaries with a black invading spot at the end of the cell and a creamy yellowish costal patch in front of the apex. Under-side. Primaries like the male but with all the spots larger and darker, and between the cell spots large patches of very pale (washed out) orange. Secondaries similar to the male but with the spots darker, and a white oblique broken stripe right across the wing across the middle of the cell edged by a broad indefinite suffusion of golden brownish, termen with a similar suffusion.

Expanse ♂ 52, ♀ 54 mm.

This species is only recorded from Cooktown; the brilliancy of its upper-side and the paleness of the under-side, together with the small and isolated arrangement of spots beneath, will enable it to be readily separated from any other of the group.

TABLE OF THE DISTRIBUTION OF THE SPECIES OF OGYRIS.

	Western Australia.	South Australia.	Victoria and Kangaroo Island.	N.S.W.	Queensland.	New Guinea.
O. Waterhouseri . .	...	...	Bethune-Baker, ? And. and Spry.	...	...	...
O. idmo	Hew. and coll. J. J. Walker.	...	Lyell.	...	...	...
O. otanes . . .	...	Felder.	Coll. Tepper.	...	...	...
O. halmaturia . .	...	...	Tepper.	...	...	...
O. zosine . . .	...	...	Lyell.	Waterh.	Hew. and coll. Dodd.	...
O. zosine-duaringa . .	...	...	...	...	Miskin and coll. Meek (Tring Mus.).	...
O. zosine-magna . .	...	...	...	...	Coll. Waterh., coll. Bethune-Baker.	...
O. meeki . . .	...	...	...	...	...	Rothschild.
O. abrota . . .	...	...	And. and Spry.	Doubleday. Waterh.	Waterh.	...
O. ianthis . . .	...	...	...	Waterh.	Lower.	...
O. olane	...	Waterh.	And. and Spry, Waterh.	Waterh.	? Waterh. ?	...
O. barnardi . . .	...	...	...	...	Miskin and Bethune-Baker.	...
O. orœtes . . .	...	...	...	...	Hew., Waterh. and coll. Dodd.	...
O. hewitsoni . . .	...	...	And. and Spry.	...	Hew., Waterh. and coll. Dodd.	...
O. hewitsoni-meridionalis	...	...	Waterh. and Bethune-Baker.	...	...	...
O. amaryllis . . .	...	...	...	Waterh.	Hew.	...
O. ænone . . .	...	...	...	...	Waterh. coll. Turner (Cooktown).	...

CHARACTERS OF THE GENITALIA OF THE SPECIES OF OGYRIS.

	Clasps.	Girdle.	Tegumen.	Falces.	Penis-sheath.
O. idmo . . Plate xv, fig. 10 and 10*a*.	Broad, excavated for the lower half of apex, upper half nearly rectangular.	Strong, with the inner margin curved over so as to appear semi-tubular.	Very ample, outer outline nearly even.	Heavy and long, with a very broad upward curve, tapering very rapidly from the curve to the apex.	Rather long, orifice expanded, large and copious.
O. otanes . . Plate xv, fig. 2 and 2*a*.	Elongated, lower part of apex suddenly excavated in a circular form, upper part produced and somewhat rounded.	Rather weak, and narrow.	Ample, with upper part slightly produced.	Lighter with a sharp upward curve.	Similar to *idmo*, but rather smaller.
O. halmaturia . Plate xv, fig. 3 and 3*a*.	Broadish, subtriangular shortened as to its lower apex, slightly excavated in the centre, obtusely and slightly produced as to its upper half.	Strong, somewhat broad.	Very ample, produced backwards in a strong curve, outer margin even.	Strong long, similar to *idmo*, but rather smaller.	Shorter, more even in shape with orifice less expanded, less copious and smaller.
O. zosine . . Plate xv, fig. 5 and 5*a*.	Very broad with lower apex rounded, deeply excavated above, with upper portion and apex subrectangular.	Broad and shorter than usual.	Very ample, extending nearly half down the lateral supports with the outer margin even.	Strong and long with an acute curve (almost angled) above the centre, apex slightly curved also.	Short, very broad at the base, straight gradually tapering to the orifice, which is small and tubular.
O. abrota . . Plate xv, fig. 6 and 6*a*.	Very broad and short, with lower and upper apex strongly produced, the former rounded, the latter almost hooked.	Of medium width, tapering rapidly to the base.	Moderately ample, hollowed at the outer margin, slightly produced at the vertex, the lower extremities lobe-shaped.	Slender, slightly curved, with the elbow right at the base.	Stout, of nearly uniform width, slightly hollowed in the centre with the orifice somewhat funnel-shaped.
O. ianthis . Plate xv, fig. 9 and 9*a*.	Sickle-shaped with very broad bases, with the outer extremity of the base produced outwards.	Slight, rather long, tapering very slightly towards the tegumen.	Ample, hind vertex produced upwards into a point with the girdle, front margin straight.	Rather slender, slightly curved, with the elbow right at the base.	Stout, of nearly uniform width, but slightly expanding towards the orifice, which is slightly funnel-shaped.

O. olane . Plate xv, fig. 8 and 8*a*.	Long and narrow, curved, apical third narrower. A slight bulb at the extreme base of the clasp. Apex slightly curved and re-curved at the extremity.	Ample, tapering broadly to the tegumen.	Ample, hind vertex produced upwards similarly to *ianthis*, but projected backwards, also front margin slightly waved.	Rather slender, sharp, curved, with elbow right at the base.	Of moderate length, hollowed in the centre, with orifice trumpet-shaped.
O. barnardi . Plate xv, fig. 7 and 7*a*.	Longish, narrow, two-thirds from the base is a sudden excavation from whence to the apex it narrows, and terminates in a fine lip-like extremity.	Very ample, very broad, almost down to the base.	Narrower but large, hind vertex produced upwards, front margin waved.	Slender and straight, for the apical three-fifths where they are very acutely elbowed below which they are curved and broader.	Of moderate length and width, tapering suddenly at a fifth from the apex.
O. orœtes . Plate xv, fig. 4 and 4*a*.	Moderately narrow, curved, tapering to a point at the apex, slightly bulbous for the basal half.	Ample, and moderately broad to somewhat near the base.	Very ample, slightly produced forward, with front margin waved.	Rather slender, with the elbow curve very broad, apex slightly hooked.	Moderately long, hollowed in the centre, rapidly expanding to a quarter from the apex, whence it decreases rapidly to the extremity.
O. hewitsoni * . Plate xv, fig. 11 and 11*a*.	Moderately broad for the basal half when it suddenly narrows and terminates with a blunt rounded apex.	Narrow and long, strongly curved in the middle so as to form almost an angle.	Less ample than usual, somewhat produced at the top apex, and produced into lobes at the lower extremities.*	Slender, strongly elbowed near the base, with tip hooked.	Rather short and narrow, slightly expanding at the apex.
O. amaryllis . Plate xv, fig. 1 and 1*a*.	Unusually broad and large, excavated at the apex for its lower portion, above which it is strongly produced forward, with its extremity waved, and squarish in shape.	Of moderate width and fairly long.	Ample, apex slightly produced forwards, front margin slightly hollowed.	Slender, curved, with the elbow right at the base terminating in distinct hook.	Long, narrow, suddenly expanding into a wide orifice about a third from that extremity.

* The shape and position of the genitalia of this species is so unusual that I believe death must have taken place almost during copulation.

Explanation of Plate XV.

Fig. 1. *Ogyris amaryllis*, genitalia profile
1*a*. „ „ penis.
2. „ *olanes*, genitalia.
2*a*. „ „ penis.
3. „ *halmaturia*, genitalia.
3*a*. „ „ penis.
4. „ *orœtes*, genitalia.
4*a*. „ „ penis.
5. „ *zosine*, genitalia.
5*a*. „ „ penis.
6. „ *abrota*, genitalia.
6*a*. „ „ penis.
7. „ *barnardi*, genitalia.
7*a*. „ „ penis.
8. „ *olane*, genitalia.
8*a*. „ „ penis.
9. „ *ianthis*, genitalia.
9*a*. „ „ penis.
10. „ *idmo*, genitalia.
10*a*. „ „ penis.
11. „ *hewitsoni*, genitalia
11*a*. „ „ penis.

XVII. *The structure and life history of Psychoda sexpunctata*, Curtis. By John Alexander Dell, B.Sc. Communicated by Prof. L. C. Miall, F.R.S., F.E.S.

[Read May 3rd, 1905.]

Habitat and Mode of Life.

Psychoda in all stages of growth abounds throughout the year at the Leeds Sewage Works, and advantage has been taken of this circumstance to investigate more fully the life history of the insect. It obtains its food from heaps of coke, over which crude sewage is sprayed during the purifying process. The life which flourishes on the coke-heaps, and especially the bacterial life, effects the reduction of the sewage to a harmless liquid. Algæ, among which *Stigeoclonium tenue* is conspicuous, find here congenial conditions, and supply nutriment to insects of more than one kind. Besides *Psychoda*, a *Chironomus* and a beetle (*Platystethus*) occur. A *Scolopendra*, Mites, and *Nais* have also been observed on the coke-heaps.

The *Psychoda*-larva is minute, cylindrical, tapering toward the hinder end, and bluntly rounded in front. It may attain a length of 7·5 mm. The larva bears no locomotor appendages, but moves in a vermiform manner. On the fore part of the head are a pair of jaws, probably mandibles, which can be extended forwards, or folded backwards. By means of these and the recurved labrum food is crammed into the mouth. The last segment is usually bent upwards so as to keep its tip, which bears the only functional spiracles, clear of the semi-liquid filth in which the rest of the body is usually immersed. The pupæ are found together with the larvæ in the sewage.

The fly is small and of grey colour. The female is 4 to 4·5 mm. long, the male only 2·5 to 3 mm., including the wings. The male is further distinguished by the large genital appendages, which project from the extremity of the abdomen. The wings are longer than the body, which they completely cover, and slope when at rest. Both

body and wings are abundantly covered with grey hairs, which give the fly at first sight the appearance of a small moth, hence the name *Psychoda*. Round the edges of the wings are a few black tufts, and the veins are thickly covered with hairs. The hairy surface protects the body from accidental wetting. A fresh-killed fly, when pressed below the surface of the water, carries down with it so large a quantity of air, that on being released, it shoots at once to the top and remains floating. The flies may often be observed resting on the windows of empty houses, and are also abundant in privies, urinals, etc. At the Leeds Sewage Works they cluster on the under-side of the pieces of coke upon which the sewage is sprayed. They are sluggish, and do not readily take to flight. In returning from the sewage works to the University I have often found that the walk of three or four miles was insufficient to dislodge *Psychoda* flies which had clung to my dress. They can, however, run fast, and they are sometimes carried far by wind. The fly does not, so far as is known, feed at all.

In copulation the male runs alongside the female, stroking her with his antennæ, while the wings, antennæ and halteres are thrown into spasmodic vibration. The large forceps is then extended directly backwards, and the abdomen of the male bent round so that the hinder ends of the two bodies are brought into apposition. The forceps then close upon the body of the female, unless they miss, which not infrequently happens, as the male fly is unable to see what he is doing. In such a case the whole manœuvre is repeated. The males are apparently unable to distinguish which of their companions are females, as they very frequently attempt to copulate with one another. They have often been seen to die while still attached to the female.

As usual in *Nemocera* the eggs are deposited in an elastic, jelly-like mass. They are irregularly arranged in it, and unconnected with one another. The egg-mass thus formed is indefinite in shape, and may be fixed to a stone or other solid object. The total length of an egg-mass may be 1–2 mm., and such an egg-mass commonly contains 35–40 eggs. The eggs are small (·2 mm. to ·3 mm. in length) and sausage-shaped; they are opaque, and loaded with yolk-granules. Hatching takes place 10–14 days after laying, but may possibly be more rapid in a

warmer season than that in which my observations were made.

Systematic position of Psychoda sexpunctata.

The long antennæ of many similar joints, and the slender flexible maxillary palps, at once place *Psychoda* among the *Nemocera*. The absence of ocelli, the short and fleshy mouth-parts, the bead-like joints of the antennæ, the prominent genital forceps, and the structure of the wings characterize the *Psychodidæ*. The pattern of the wing-veins sufficiently indicates the genus *Psychoda*, while the black tufts on the margin of the wing distinguish the species *sexpunctata*.

External features of the Larva (Fig. 1).

The body consists of a head and eleven segments. Each of the first three segments is imperfectly divided into two annuli, and each of the remaining ones into three. The last segment is the only one which is extensively modified. The integument is covered with a thick layer of chitin, which is in places thickened into special protective plates. In general there is a thin membrane between the adjacent segments, and a longitudinal thin strip separating the dorsal from the ventral armour. The cuticle of a larva which has recently shed its skin is white and transparent, and such larvæ can be easily studied alive as transparent objects. As time goes on, however, the cuticle thickens, and a larva which has a moult in prospect becomes com-

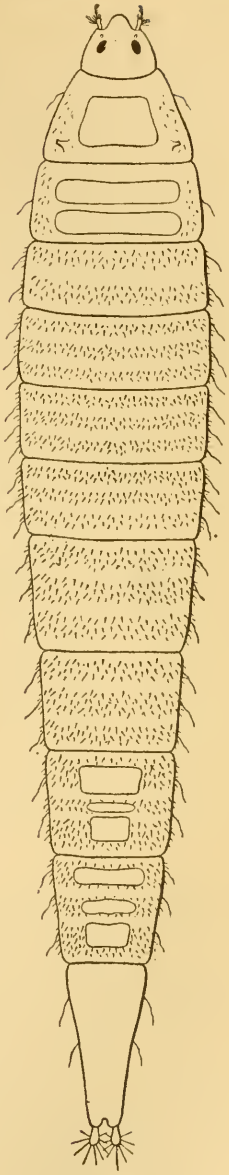

Fig. 1 (× 20).
Dorsal view of larva.

pletely brown and opaque. From the middle of each segment a pair of lateral setæ project, which are more or less curved. There are also on all the segments except the first and second numerous short, rather blunt setæ, arranged in transverse bands; there are two of these bands on the third segment, and three on each of the others. In the mid-dorsal line of the ninth and tenth segments occur a series of black, oval, shining plates, transversely elongated, but not reaching the sides of the body. There are usually three on each segment, but they are irregular in form and size, and occasionally one is found on the eighth segment. The last or eleventh segment is smooth and hard, and tapers backwards, though

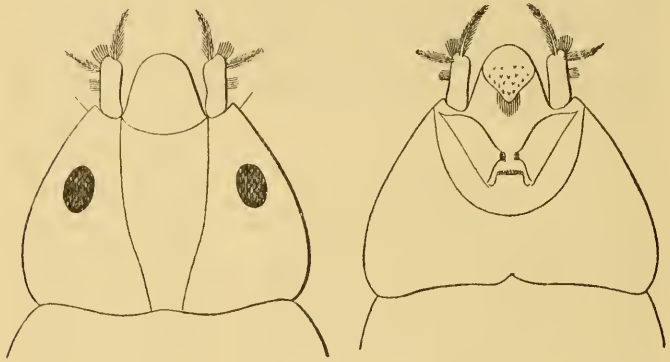

Fig. 2 (× 80).

Dorsal view of head of larva (to left); ventral view (to right).

the extreme tip is truncated. The anus opens on its under-side, in a recess at the attached end of the segment. There are two small appendages arising from the truncated terminal surface of this segment. They are short, fringed with setæ, and somewhat like the corresponding structures in the *Pericoma* larva, but not so much developed. As in *Pericoma*, the larvæ can hang from the surface-film by means of the anal appendages. If depressed beneath the surface, the anal appendages do not carry down a bubble of air, with which the spiracles communicate, as in the *Pericoma* larva, though small air bubbles often adhere to the setæ. When floating at the surface, the larva, if it is able to reach the bottom, can drag itself along by means

of the mouth-appendages, which are rapidly extended and closed, so as to scrape the bottom.

The head (Fig. 2) is subconical, much reduced, and partly retractile. It can be withdrawn into the prothorax, so that the head is concealed as far forward as the eyes. This position is temporarily assumed during crawling, and is normal in larvæ about to pupate. The head nearly resembles that of *Pericoma** and *Maruina*.† In each case the mid-dorsal surface is occupied by the roughly triangular clypeus, flanked on either side by the large epicranial plates, which bear the black, shining, simple eyes, and the antennæ. The antennæ are even more reduced than in *Pericoma*, and are little more than knobs. The forward prolongation of the clypeus is the labrum. This is an elongated triangular organ; its apex is turned underneath in such a way that the tip lies almost directly beneath its junction with the clypeus. A few hairs arise from its anterior edges, and on the surface of the apical part, which is morphologically dorsal, but actually ventral, there occur a large number of backward-directed spines. On each side of, and immediately behind the labrum is an appendage, probably the mandible, which is short, and ends bluntly. From each appendage arise two large plumose setæ, one running forward, the other outward. There are also two bunches of shorter setæ. Immediately behind the supposed mandibles is a pair of semi-circular, plate-like appendages, which probably represent the maxillæ. Between them and in the median line is a comb-like organ with its teeth projecting forwards. A similar plate is common in *Nemocera* larvæ, and has been identified with the submentum.‡

Nervous System of the Larva.

The nervous system (Fig. 3) consists of the usual cerebral ganglia and the ventral chain. The cerebral ganglia are pear-shaped, and from their pointed ends arise a pair of nerves, which run forwards into the head. The sub-œsophageal ganglia are, as usual, connected with the cerebral so as to form a ring round the œsophagus, through which runs the dorsal vessel. Behind these is a series of

* Miall and Walker (1895). † Müller (1895).
‡ Miall and Hammond (1892 and 1900).

eleven ganglia, not segmentally arranged. The hindmost of the chain is small, and close to the one immediately in front of it. The first body-segment contains, in addition to the first ganglion of the ventral chain, the cerebral and sub-œsophageal ganglia, which in most insects lie in the head. The shifting of these ganglia into the thorax is no doubt explained, as in the case of *Chironomus*, by the reduction of the larval head. The large and complex head of the fly cannot be developed within the small larval head, and its rudiments, besides the brain, which it will ultimately enclose, are transferred to the much more spacious prothorax.*

FIG. 3. Nerve-cord of larva.

Alimentary Canal of the Larva.

The alimentary canal resembles that of *Chironomus* † so closely that I shall merely describe the points of difference between the two. The fore-part of the stomach is separated as a cardia, but has no cæca. Between its wall and the reflected wall of the œsophagus arises a thin chitinous membrane, the "peritrophic membrane" of Balbiani.‡

The function of the peritrophic membrane is to protect the mesenteric epithelium from abrasion by inorganic particles, which the larva swallows along with its food. It is apparently cast periodically. In a living *Psychoda* larva reversed peristaltic contractions have been observed. The digested food has been seen to be carried up into the space between the peritrophic membrane and the mesenteric epithelium by these peristaltic contractions. At the hinder end of the mesenteron is a slight dilatation, into which open the five Malpighian tubules. Five is an unusual number of tubules among insects, but it is found in *Blepharoceridæ*, *Culex*, and *Ptychoptera*.§

There is a pair of salivary glands situated in the fore-part of the thorax. They are roughly bean-shaped, and the duct arises from the part corresponding to the hilum

* Miall and Hammond (1892, 1900).
† Miall and Hammond (1900). ‡ Balbiani (1890).
§ Müller (1895).

of the bean. They are placed one on each side of the alimentary canal, which they partly encircle. The two ducts run forward beneath the alimentary canal, and unite in the posterior region of the head. The structure of the glands is very simple. They are hollow, the wall being only one layer of cells thick. The cells are very large, and possess very large nuclei, in which by suitable methods a distinct chromatic filament and nucleus can be made out. I have not been able to detect the elaborate nuclear structure of the salivary cells of the *Chironomus* larva.* Outside the cells there is a thin basement-membrane.

Respiratory System of the Larva (Figs. 4–6).

The respiratory system of the larva is well developed. The air is renewed mainly, if not altogether, by means of the large posterior spiracles (Fig. 6). These are situated at the apex of the last segment, close to the bases of the minute anal appendages. Each spiracle communicates with a large longitudinal trachea. Immediately within the spiracle the trachea is slightly dilated into an oval chamber, and the centre of this is occupied by an ovoid mass of chitin, attached to the walls of the chamber by chitinous threads. The whole arrangement forms a kind of loose spongy plug. In addition to this pair of large posterior spiracles, there are an anterior pair borne by two short processes on the sides of the prothorax (Fig. 4). They are not open, and probably not functional, since they are always immersed in water or mud. Leading into each spiracle is a trachea, which, as it passes into the process on which the spiracle is borne, gradually becomes spongy and takes on a black appearance as seen by the microscope, probably due to contained air.

There are two very large tracheæ (Fig. 4), each arising from one of the posterior spiracles, and running forward along the back. They are connected by a series of commissures, one of which occurs at the hinder end of every segment, except the last. In many cases small, forward-directed branches arise from the commissures. Some of these are connected with the alimentary canal, and on this account the commissures are very slack, especially those near the middle of the body. During the

* Balbiani (1881).

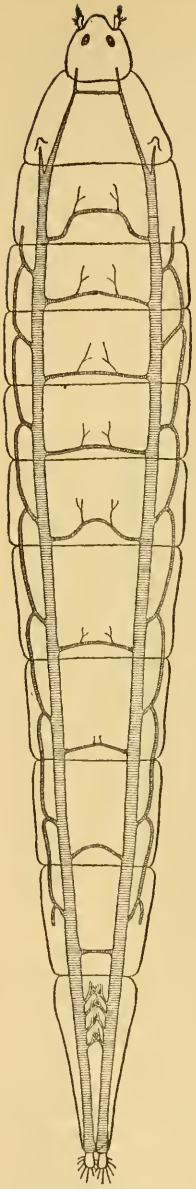

Fig. 4 (× 20).
Tracheal system of larva.

vermiform movements of the animal there is a considerable amount of sliding of the alimentary canal and body-wall on one another, and a tight commissure would be liable to be snapped, or to tear the tissues. In each segment, besides the commissures, there is found a lateral branch running downward and forward, and soon splitting into three. Of these three each posterior branch unites with the

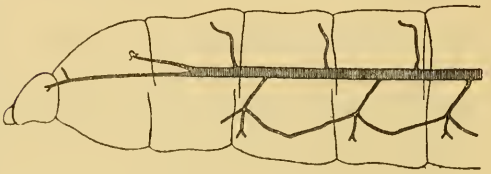

Fig. 5 (× 20).
Anterior part of tracheal system of larva, in side view.

anterior branch of the segment behind, thus forming a loop, while the middle branch breaks up into branches of distribution. In the last segment, immediately dorsal to the hinder part of the heart, there arise from each

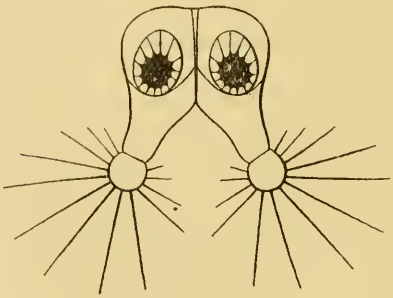

Fig. 6 (× 100).
Posterior spiracles of larva.

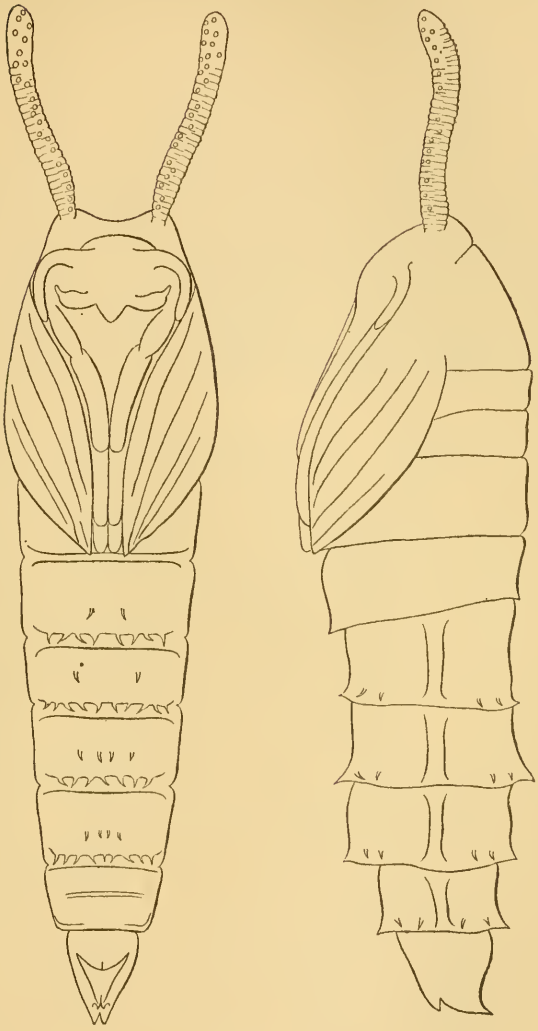

Fig. 7 (× 20).

Ventral view of pupa (to left); side view (to right).

longitudinal trachea a number of small branches, which break up into branches of distribution in the neighbourhood of the pericardium.

Pupation: External Features of the Pupa.

After reaching its full size, the larva becomes sluggish and ceases to feed; the head becomes retracted, so that the part behind the eyes is concealed by the first body-segment; the last larval skin is then shed, and the pupa emerges. This takes place while the animal is still buried in slime. In a short time the pupa makes its way to the surface, where it lies with the respiratory appendages exposed. This facilitates respiration, and the escape of the fly.

The pupa (Fig. 7) is, as usual, shorter and thicker than the larva. When it first appears it is white, but the cuticle soon thickens and turns brown. The head is not externally marked off from the rest of the body, but the compound eyes of the fly can be seen through the pupal skin. From the front of the prothorax arise the two respiratory appendages (Prothorakalhorne of De Meijere*). They are rather less than one-third of the length of the body, and transversely wrinkled. Scattered over their surfaces, especially towards the distal end, occur numerous transparent circles, which appear to be holes, but are really thin spots in the cuticle. A shallow transverse furrow separates the prothorax from the mesothorax. The three pairs of leg-sheaths are straight, and reach the beginning of the third abdominal segment, where the tips of the wing-sheaths are also situated. All the exposed abdominal segments, except the eighth or last, are protected by dorsal and ventral plates, whose hinder margins end in rows of backwardly-directed spines. There are also a few scattered spines on both dorsal and ventral surfaces. Each spine is a pointed process of the body-wall. Its apex bears a spike set in a socket. The last segment bears four large spines, two terminal and two subterminal. The spines assist the pupa to move about in the filth in which it is buried, and so keep the respiratory appendages exposed to the air.

* De Meijere (1902).

Tracheal System of the Pupa (Fig. 8).

The tracheal system of the pupa is closed, the contained air being renewed by means of the prothoracic respiratory appendages, a pair of hollow finger-shaped processes, which project forward from the prothorax. A tracheal extention (Fig. 9)—Hornfilzkammer of De Meijere—lies within the respiratory appendage. The structure of the wall of the pupal respiratory appendage is not unlike that of *Ptychoptera*. In places the tracheal extension bulges through the wall of the respiratory appendage, giving

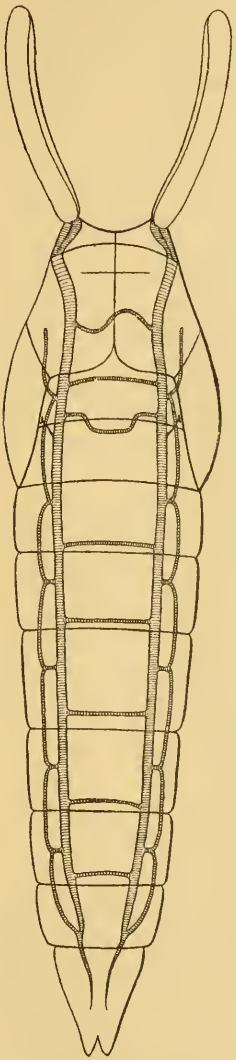

Fig. 8 (× 20).
Tracheal system of pupa.

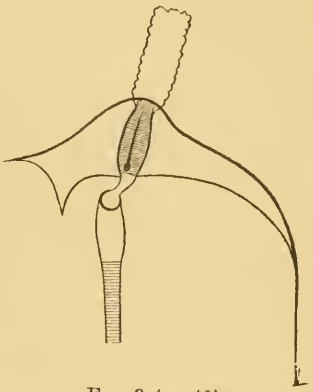

Fig. 9 (× 40).
Tracheal extension of pupa.

Fig. 10 (× 100).
Transverse section of tracheal extension of pupa.

rise to the clear circular spots previously mentioned. Except at these places the tracheal extension is separated from the wall of the respiratory appendage by a space, in which sections show the presence of a tissue, affected by ordinary staining re-agents (probably the epithelium which secreted the tracheal extension). A transverse section shows scattered setæ projecting inwards from the wall of the tracheal extension (Fig. 10). Traced backwards, the tracheal extension passes through the space between the body of the fly and the pupal skin, and finally enters the body in the fore part of the mesothorax. There are two large, longitudinal tracheæ (Fig. 8) communicating directly with the tracheal extensions just described. They are connected by a series of nine commissures, one in the mesothorax, two in the metathorax, and one in each abdominal segment, except the seventh and eighth. There is also a series of lateral loops exactly like those of the larva. The first, however, which arises in the metathorax, runs through two segments; all the others run from one segment to the next. The longitudinal tracheæ end in tapering extremities in the last segment.

The tracheal system of the pupa is formed around that of the larva, and consequently in a larva about to pupate the walls of the tracheæ appear double. The longitudinal tracheæ of a late larva communicate with the pupal respiratory appendages, which are formed during this stage. The respiratory appendages are not modelled on any pre-existing larval organ, hence it is not surprising to find that the larval trachea, just behind the respiratory appendage, comes out through the wall of the pupal tracheæ, and makes its way to the prothoracic spiracle of the larva. It is also continuous with the base of the respiratory appendage. This makes a sharp angle with the larval trachea, and can be seen through the larval cuticle just in front of the larval prothoracic spiracle. Its distal end turns downwards, and almost touches its fellow of the opposite side in the mid-ventral line. In the pupa which has just shed the larval skin, the respiratory appendages lie close to the body, much as they do in the larva; but when the pupa makes its way to the surface of the mud, the respiratory appendages stiffen, and stand out clear of the surface. Pupæ can be easily detected in a sample of sewage, by their projecting respiratory appendages. A pupa, when kept in a bottle of water, is unable to rise to the surface,

or to breathe the air dissolved in the water, and dies in a few days.

The Head and its Appendages in the Fly.

The head is almost vertical. (Figs. 11 and 12.) Seen from above it is transversely oval; the front surface is pear-shaped, narrowing downwards to the labrum. The com-

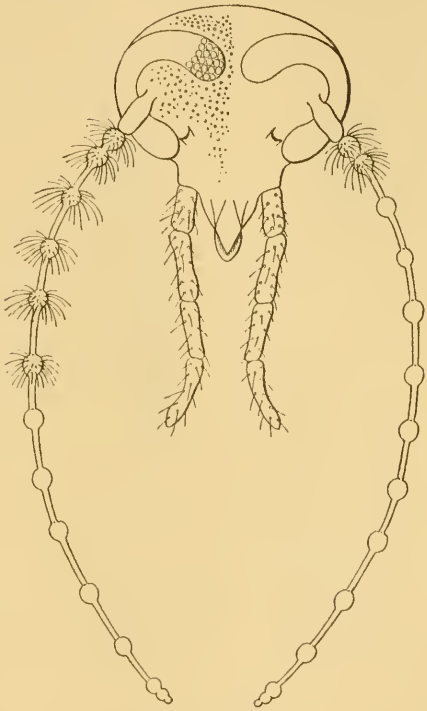

Fig. 11 (× 80).
Head of fly.

pound eyes are horse-shoe shaped, and nearly meet above. They contain comparatively few ommatidia, not more than five or six rows in the widest part, and possibly about eighty in all.

Immediately within the lower ends of the horse-shoe-shaped compound eyes can be seen in the openings of a pair of chitinous tunnels which perforate the head. They run through it obliquely, and their openings on the back of

the head are nearer to one another than the openings on the face. The tunnels are not of absolutely uniform diameter, though their variations are nowhere very great.

The antennary muscles, which are the only important muscles in the head, are attached close to the hinder openings of the chitinous tunnels, which seem to act as struts, and prevent the head from yielding when a strain

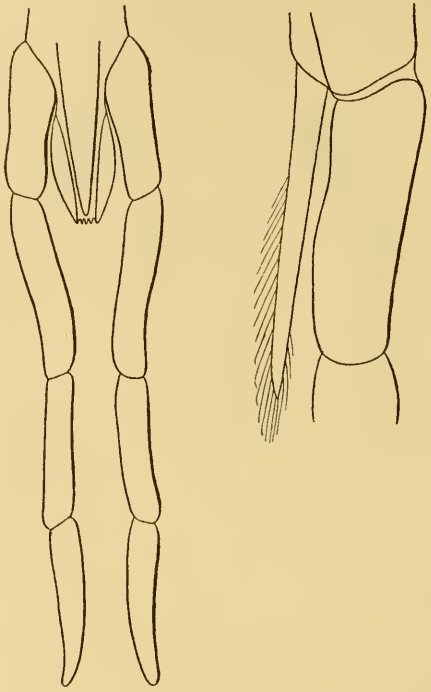

Fig. 12.

Ventral view of mouth-parts of fly (to left); maxilla in side view (to right).

is put upon it by the contraction of the antennary muscles.

Similar structures have been described in *Anopheles*, where a pair of straight chitinous tunnels perforate the head, and in *Chironomus*, where a pair of small openings on the face open into a pair of somewhat irregular chambers, which in turn open to the exterior by a pair of slit-like apertures on the back of the head.*

* Miall and Hammond (1900).

In the *Chironomus* fly the antennary muscles are attached to the walls of the chitinous invaginations themselves, an interesting point of difference from *Psychoda*. A somewhat similar pair of structures has been described in some other insects, notably in *Corydalis*.*

Each antenna consists of fifteen joints; of these the first is cylindrical, the second globular, and the others flask-shaped, with the exception of the last three, which are globular. From the globular part of each joint arise a number of curved, radiating setæ.

The fly apparently does not feed at all, since no traces

Fig. 13 (× 20).

Side-view of male fly. The wing is extended and cut short; the legs cut short. The lower figure shows the genital armature in plan.

of food have been observed in its reduced alimentary canal, nor has it ever been seen to take in food. The mouth-parts (Fig. 12) are somewhat similar in arrangement to those of *Culex*, but are very largely atrophied. As in most Diptera, there is a roughly conical rostrum, which bears an elongated, triangular labrum, behind which is the short, bilobed labium. This is fringed with numerous,

* Waterhouse (1895).

short, finger-like processes, and its edges are rolled forwards so as to enclose a pair of maxillæ. The maxillæ are short, styliform, and fringed with setæ; near the base they give rise to a pair of long, four-jointed maxillary palps. The styliform maxilla probably corresponds to the lacinia of typical forms; there does not appear to be anything to correspond to cardo and stipes. On the front of the labium is a minute, triangular hypopharynx or lingua.

The Thorax of the Fly.

As usual in Diptera, the thorax of *Psychoda* (Figs.

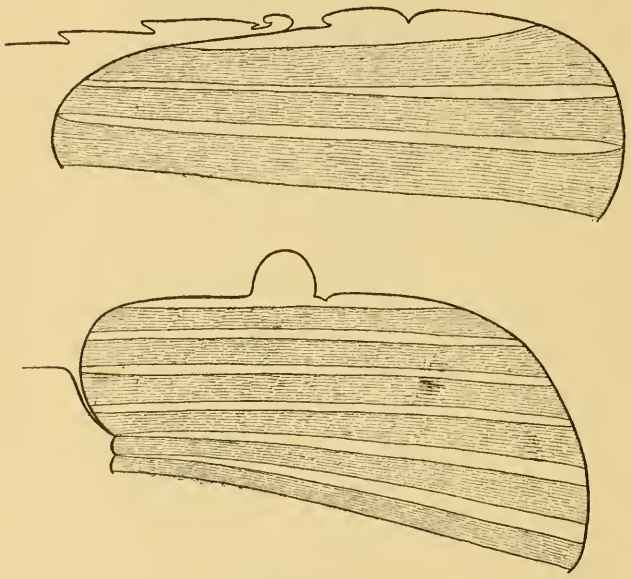

Fig. 14.

Longitudinal section of thorax of *Psychoda* (upper fig.); ditto of *Chironomus* (lower fig.).

13, 14) consists of a small prothorax, an enormous mesothorax, and a small metathorax. The prothorax is little more than a ventral hoop, containing the muscles of the first pair of legs. Ventrally and laterally its hinder margin is indicated by a suture. Dorsally its boundary is uncertain; it certainly, however, lies in front of the first spiracle.

The relations of the component parts of the mesothorax are peculiar, as will be seen by comparison with the corresponding structures in *Chironomus* (Fig. 14). In that type the dorsal region of the mesothorax consists of a large shield-shaped piece, the scutum; a transverse, semicylindrical ridge, arching across the back, the scutellum; and behind this a large postscutellum, to which the hinder ends of the longitudinal mesothoracic muscles are attached.*

In *Psychoda* the same parts are found with the following points of difference:—

(1) The scutum extends forwards above the head, so that the head and prothorax are depressed to the ventral side, and the face looks downwards.

(2) In *Chironomus* the post-scutellum has extended backwards so far as to obliterate the dorsal part of the metathorax. In *Psychoda* the post-scutellum extends back quite as far as in *Chironomus*, but underlies the metathorax and the dorsal part of the first and second abdominal segments. It thus appears in longitudinal section as an enormous dorsal invagination of the cuticle, running backwards and downwards into the body as far as the hinder end of the second abdominal segment. I am informed by Mr. T. H. Taylor that a somewhat similar state of things is found in *Simulium*.

The dorsal part of the metathorax is a narrow strip, arching across the back immediately behind the scutellum. At the sides of the metathorax are the club-shaped halteres, or rudimentary second pair of wings, and the metathoracic spiracles.

The mesothorax is chiefly occupied by the muscles of flight, which are of extraordinary size, the longitudinal muscles, for instance, being half as long as the body.

There are two pairs of spiracles. The anterior, which is mesothoracic,† is formed at the place where the tracheal extension from the pupal respiratory appendage enters the imaginal body. Just at this point the cuticle of the fly thickens into a partial ring, while immediately distal to it

* Miall and Hammond (1900).

† Voss (1905, p. 739) concludes from his study of *Gryllus domesticus* that the thoracic spiracles are probably prothoracic and mesothoracic. Miall and Hammond, on the other hand, find that they are mesothoracic and metathoracic in *Chironomus*, while Taylor (1902) comes to the same conclusion in his paper on *Simulium*.

the tracheal extension is thinner than anywhere else, and lacks the annular thickenings. This appears to be an arrangement for snapping the tracheal extension just at the required spot. Whether the pupal tracheæ persist as those of the adult, or whether all those of the thorax are withdrawn through the adult metathoracic spiracle, I am unable to say, but in all pupal skins hitherto examined no trace of tracheæ could be discovered, while the end of the tracheal extension always appeared to have been snapped across just where it originally entered the imaginal thorax. The metathoracic spiracle is a small, circular opening immediately below the base of the haltere.

The Abdomen of the Fly and its Appendages (Fig. 13).

The abdomen consists of eight segments. The first of these is only distinguishable dorsally, being ventrally obscured by the bases of the metathoracic legs. The seventh segment shows some indication of being divided into two parts. The last (eighth) segment in the male is flattened from above downwards, and slightly bifurcated at its hinder end, from which arises a long forceps, reaching forwards when at rest as far as the middle of the seventh segment. It is composed of two joints, a large basal and a small terminal one. From the fore end of the eighth segment arises a second forceps, also two-jointed. This runs upwards and backwards, and is enclosed by the other. There are also two processes arising from the hinder end of the seventh segment in the middle line; one is dorsal to the other. They are possibly analogous in function to the penis and titillator of a cockroach.

In conclusion, I desire to express my indebtedness to Professor Miall, at whose suggestion the work was first taken up, and without whose assistance and encouragement it could never have been carried out, and also to Mr. T. H. Taylor for much helpful advice and criticism.

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XVIII. *New African* Lasiocampidæ *in the British Museum.* By Chr. Aurivillius, Hon. F.E.S., F.M.Z.S., etc.

[Read June 7th, 1905.]

Plate XVI.

In a collection of seventy African *Lasiocampidæ* kindly sent to me for determination by Sir G. F. Hampson, I have found some new species described in this paper. Three of the species belong to new genera, of which *Haplopacha* and *Chondrostegoides* are of interest as representing the aberrant genus *Chondrostega* in the Ethiopian region.

I have to thank the Entomological Society of London for the beautiful figures illustrating my papers.

Gonometa regia, n. sp.

(Plate XVI, fig. 3.)

♀. Ochreous-brown or yellowish-brown; patagia, mesonotum, legs and under-side of abdomen with a distinct violaceous or purplish tint; fore-wing ochreous-brown the basal fourth and four transverse sinuous bands violaceous-brown, the outermost band ending at vein 2, the median space between band 1 and 2 more or less suffused with violaceous, outer margin darker than the ground-colour between the bands; hind-wing reddish-brown, broadly yellowish at base of inner margin; under-side of both wings ochraceous, violaceous-brown at costal margin, fore-wing behind middle with an obsolete brownish transverse band.

Expanse 155 mm.

Uganda: Hoima (*S. C. Tomkins*).

This giant moth is most nearly allied to *G. titan*, Holl., which, however, has a much darker ground-colour without violaceous tint and obsolete transverse bands of fore-wing.

Gastroplakæis rufescens, n. sp.

(Plate XVI, fig. 10.)

♀. Head, thorax, legs and under-side of abdomen pale greyish-brown with a pinkish tint; abdomen above ochraceous-yellow darker at base and without black transverse bands; fore-wing pale greyish-brown with a pinkish tint, two waved brown transverse lines before middle and two such lines about middle, an obsolete angulated brown submarginal line and a black dot at apex of cell, hind border with long grey or blackish hairs and scales; hind-wing pale yellowish broadly suffused with fawn colour at apex and outer margin; wings below pale fawn colour, yellowish towards base without markings.

Expanse 97 mm.

W. Africa: Asaba.

Pseudometa patagiata, n. sp.

(Plate XVI, fig. 1.)

Dark umber-brown, with the patagia yellow; fore-wing with a white dot at end of cell and two yellow patches mottled with reddish-brown, one at base of hind margin occupying the base of the areas 1a, 1b, 2 and 3, the other beyond the cell between veins 5 and 6; an irregular submarginal series of fuscous spots.

Expanse 37 mm.

Riv. Niger: Sapele (*F. W. Sampson*).

This species differs from *P. viola* in the more elongate hind-wings. Veins 9 and 10 of fore-wing are somewhat longer than their common stalk.

♂ Anadiasa cervina, n. sp.

(Plate XVI, fig. 5.)

Fawn colour; abdomen paler, testaceous. ♂. Fore-wing fawn colour with three fine, simple, fuscous transverse lines, the first subbasal nearly erect and very indistinct, the second a little behind middle, evenly excurved from costa to vein 5, thence incurved to middle of hind margin, third line submarginal, uneven and more or less dissolved into spots, a small whitish dot at end of cell; hind-wing pale testaceous. ♀ differs by the fore-wing being darker and

suffused with grey at hind margin and outer margin and by the hind-wing being nearly as dark as fore-wing.

Expanse 33–35 mm.

Natal: *Brit. Museum*; Nyassaland and German East Africa: *Museum Holmiæ.*

Nearly allied to *A.* ("*Philudoria*") *distincta*, Dist., but differing in the simple transverse lines of fore-wing and by the median line not being strongly incurved at costal margin.

Taragama capensis, n. sp.

(Plate XVI, fig. 11.)

Abdomen, under-side of thorax and legs greyish-brown; palpi yellowish; head and upper-side of thorax whitish, the latter with pale brown patches; fore-wing fuscous-brown with two oblique, very irregularly sinuated, white transverse lines, inner line from middle of costal margin to hind angle of cell and thence following the median vein to middle of cell and ending at hind margin near base, outer line from costal margin to vein 3 nearly parallel to outer margin but forming two distinct projections on inner-side at veins 5 and 8, from vein 3 running obliquely to middle of hind margin and forming two lunules, a spot at base in 1b, a spot at end of cell and a submarginal series of spots yellowish; hind-wing fuscous with transverse white line and a yellow spot at anal angle; wings below fuscous with an irregular transverse submarginal white line and one or two yellowish spots near anal angle.

Expanse 45 mm.

Cape Colony: Brak Kloof, April (*White*).

Allied to *Targama cristata* but smaller and also differing in the yellow spots and the darker ground-colour of the wings.

Taragama distinguenda, n. sp.

(Plate XVI, fig. 13.)

♂. Body brown, darker on upper-side; patagia deep castaneous brown; fore-wing dark castaneous brown paler towards outer margin, an obsolete blackish dot at end of cell and beyond it two transverse blackish-brown lines, the first arched and bent basally at costal margin, the second nearly straight running from costal margin just before apex to last third of hind margin; the usual hind marginal area

lanceolate slightly curved on fore-side, and terminated by a greyish line ; very strongly suffused with blackish except at hind margin ; hind-wing and under-side of both wings dark brown with pale veins.

Expanse 44 mm.

♀. Body fawn colour with the patagia deep castaneous ; fore-wing castaneous, paler behind middle, a very strongly curved transverse median line and another nearly straight oblique line from costal margin just before apex to last third of hind margin, an obsolete angulate submarginal line, hind marginal area lanceolate, fawn colour without silvery streak at front side ; hind-wing and under-side of both wings fawn colour.

Expanse 63–65 mm.

Natal : Durban, October (*G. F. Leigh*). A bred male and female. Also a female from Manau, Nyassaland, in Museum Holmiæ.

Very nearly allied to *T. graberi*, Dewitz, and perhaps only a southern form of that species. The female of *graberi* has the body greyish, the fore-wing fuscous, greyish at termen with the second transverse line running exactly to apex and bent at vein 8 ; hind-wing and under-side greyish, not fawn-coloured.

T. cuneata, Dist., has the same ground-colour, but is easily distinguished by the cuneate form and the silvery line at front-side of the hind marginal area of fore-wing.

The male has a greater resemblance to the male of *T. sjostedti*, Auriv.

(Larva dark brown with numerous pale reticulate striæ ; the thoracic somites dorsally yellow in front, the abdominal somites dorsally yellow behind and with ill-defined diamond-shaped dorsal marks ; two fine rather irregular subdorsal yellowish lines ; the hair on dorsum black, the lateral tufts white.—G. F. H.)

Taragama fusca, n. sp.

(Plate XVI, fig. 8.)

♂. Dark blackish grey ; patagia blackish brown ; fore-wing blackish, along hind margin with a lanceolate dark greyish patch, which on its fore-side near base has a silvery angulated line, behind middle a slightly curved, nearly parallel 3 mm. broad, blackish band, an obsolete irregular curved angulated blackish submarginal line ; hind-wing and under-side of both wings dark blackish grey without markings.

Expanse ♂ 33, ♀ 50 mm.

Brit. E. Africa: Ndimu (*C. S. Betton*); Kikuyu (*Crawshay*); Uganda, Kampala (*Christy*).

(♀. Fore-wing more uniform in colour, the patch on inner area paler.—G. F. H.)

The darkest species of *Taragama* known to me.

Ocinaropsis, n. sp.

Eyes hairy. *Palpi* rather long, porrect, reaching beyond the frons; last joint short, pointed. *Antennæ* nearly alike in both sexes, bipectinate to the apex; branches much longer before middle, suddenly shorter behind middle, hind row of branches at base much longer than the front row. *Legs* hairy; tarsi scaled; front tibiæ unarmed; spurs of hind tibiæ wanting. *Fore-wing* triangular, rather short; outer margin angled at vein 5; vein 2 from near base, 3 nearly from middle of cell, 4 and 5 from angle, 6, 7 and 8 stalked, 9 and 10 on a very long stalk, 9 running to the outer margin well below apex. *Hind-wing*: costal margin nearly straight, lobed at base; outer margin distinctly waved with a longer tooth at vein 2; vein 2 from behind middle of cell, 3 from before angle of cell, 4 and 5 on a short stalk; cell obliquely closed, vein 8 anastomasing with 7 near its base and thus forming a small precostal cell, which has no accessory veinlets.

Ocinaropsis obscura, ♂ ½.

Ocinaropsis obscura, n. sp.

Dark blackish grey (♀), or blackish brown (♂), thorax and fore-wing with a reddish tint in the male; fore-wing with very minute white point at end of cell and a double submarginal row of obsolescent black and yellowish minute dots; hind-wing paler, blackish at anal

angle; terminal tooth of both wings much longer in male than in female.

Expanse ♂ 27, ♀ 33 mm.

Natal: Durban (*Leigh*).

Philotherma sordida, n. sp.

(Pl. XVI, fig. 2.)

♂. Very pale fawn colour or isabelline; fore-wing pale fawn colour, darker at base and behind discal line, whitish between discocellular spot and discal line, a nearly erect slightly waved blackish line before middle and behind middle, a distinct oblique nearly straight black discal line, which at vein 9 is suddenly bent towards costal margin, a submarginal series of small black dots between the nervules, a white, black-ringed spot at end of cell; hind-wing pale fawn at costal margin, whitish towards inner margin, a fine discal black line from costa to vein 6 and a submarginal series of small black dots; under-side of both wings whitish isabelline with a submarginal series of black dots on hind-wing, discal transverse line wanting or obsolete, brownish.

Expanse 62–70 mm.

♀. Differs from the male in both wings being more or less densely sprinkled with blackish scales, especially at outer margin and behind discal line; transverse lines more distinct; discal white black-ringed spot of fore-wing wanting; tarsi black.

Expanse 96 mm.

Sierra Leone: (*Brit. Mus.* and *Staudinger's Collection*); Niger: Onitsba (*Brit. Mus.*).

Nearly allied to *Ph. jacchus*, Möschl., and *rosa*, Druce, differing from the latter in the paler ground colour and the straight discal line of fore-wing.

Lechriolepis pulchra, n. sp.

(Plate XVI, fig. 12.)

Ochraceous yellow; head, thorax and fore-coxæ densely clothed with long reddish brown hairs; antennæ at tip with blackish branches; fore-wing yellow (nearly lemon yellow), base, a transverse line before middle and another behind middle, and a submarginal irregular row of eight large spots reddish-brown, the discal area between the transverse lines except in cell and at costal margin largely suffused with reddish-brown, a reddish-brown spot at end of

cell and between the discal line and the submarginal row, another row of six reddish-brown spots from hind-margin to vein 7 ; veins blackish in marginal area ; hind-wing yellow with five reddish-brown spots from vein 2 to 7, becoming larger and more distinct towards costal margin, veins 4–7 blackish at termen ; wings below yellow with submarginal row of brownish spots.

Expanse 72 mm.

Brit. Central Africa : Fwambo.

Nearly allied to *L. varia*, Walk., but differing in the reddish suffusion of the fore-wing and probably distinct.

Beralade, Walk.

The genera *Chilena*, Walk. (1855), and *Lahca*, Wallengr. (1865), are not structurally distinct from *Beralade*. *Sena*, Walk. (1862), is also probably founded on a species of this genus.

Some of the species of *Beralade* are very nearly allied, and may perhaps only be colour-varieties. At present we know however but little of their variability. The species of *Beralade* are found in dry regions, and the larvæ feed probably on thorny bushes in the desert.

I give here a key to the African species known to me, including also the new ones described below.

Key to the African Species.

A. Tarsi ringed with black. Fore-wing without silvery mark at the end of the cell. Fore-wing with (1)–2 oblique dark stripes, one discal, the other submarginal or marginal.

a. Costa of fore-wing distinctly but narrowly ochreous yellow. Palpi orange, black or blackish on outer side.

*. Body and fore-wing whitish.

a. Stripes of fore-wing macular, composed of small streaks on the veins, or dentate. Discal stripe ending at the apex of vein 9 . 1. *B. perobliqua*, Walk.

b. Stripes of fore-wing continuous and even.

1. Discal stripe of fore-wing very oblique, ending at apex of vein 8; veins of fore-wing white, distinctly paler than the ground . . . . . 2. *B. continua*, Auriv.

2. Discal stripe of fore-wing less oblique, ending at apex of fore-wing. Veins of fore-wing not paler than the ground . . 3. *B. obliquata*, Klug.

* *. Body and wings fuscous, mouse-colour . . . . . 4. *B. fumosa*, Dist.

β. Costa of fore-wing not yellow. Palpi not, or only pale orange. Discal stripe oblique.

*. Body and wings milky-white or greyish. Outer stripe narrow, submarginal . . . . 5. *B. wallengreni*, Auriv.

* *. Body and wings dark fuscous. Stripes of fore-wing blackish; outer stripe broad marginal, composed of large spots . 6. *B. bettoni*, Auriv.

B. Tarsi not ringed, unicolorous.

α. Fore-wing with a white or silvery mark at end of cell.

*. Fore-wing reddish-fawn colour, with three oblique darker stripes. Discocellular white mark of fore-wing short and straight . . . . . 7. *B. prompta*, Walk.

* *. Fore-wing greyish or cinereous, with only one oblique, nearly submarginal stripe. Discocellular mark angulated.

a. Discocellular white mark short, not produced at hind angle to the middle of cell; oblique stripe waved and dentate, not bordered with white . 8. *B. levenna*, Wallengr.

b. Discocellular white mark produced at hind angle towards the base along the median vein nearly to middle of cell; oblique stripe nearly even, bordered with white on inner side.

1. Fore-wing more or less tinged with fawn; oblique stripe curved towards the middle of hind margin. Hind-wing without blackish patch at anal angle . 9. *B. donaldsoni*, Holl.

2. Fore-wing brownish-grey or greyish; oblique stripe nearly straight. Hind-wing with a distinct blackish patch at anal angle . 10. *B. marshalli*, Auriv.*

β. Fore-wing without white mark at end of cell. Wings yellowish-brown, fore-wing with two, hind-wing with one dark transverse line . . . . . 11. *B. simplex*, Auriv.

♀ Beralade continua, n. sp.

(Plate XVI, fig. 14.)

Milky-white or greyish-white; palpi orange, black on outer side; a yellow hair-pencil at base of antennæ; antennæ whitish with yellow branches; fore and middle tibiæ yellow on inner side; tarsi orange ringed with black; upper-side of fore-wing whitish (♂) or more greyish (♀), with the costa narrowly edged with yellow, two even and continuous oblique darker stripes, one discal from the hind margin before middle to apex of vein 8 (or 9) nearly straight or slightly curved, the other submarginal more curved and sometimes obsolete; the areas between subcostal veins usually suffused with fuscous especially in the female, a short blackish streak at the root; under-side suffused with dark fuscous, at least in anterior part. Hind-wing on both sides whitish (♂) or fuscous grey (♀).

Expanse 32–34 mm.

Machakos (*R. C. Crawshay*); Muani (*Betton*); Athi-y-mawe (*Betton*); Takaunga (*Thomas*); Uganda (*Christy*).

* May be a local race of *B. Donaldsoni*.

♂ Beralade bettoni, n. sp.

(Plate XVI, fig. 9.)

Dark fuscous grey, upper-side of thorax somewhat paler; tarsi ringed with black; fore-wing fuscous, veins paler, a blackish stripe in cell, a broad oblique, nearly straight, blackish stripe from apex to middle of hind margin, a similar marginal stripe; hind-wing and under-side of both wings dark fuscous, unicolorous.

Expanse 32 mm.

Brit. East Africa: Nakuro (*C. S. Betton*), February.

♂ Beralade (Chilena) simplex, n. sp.

(Plate XVI, fig. 6.)

Bright yellowish brown; fore-wing with two transverse, slightly curved, somewhat oblique and nearly parallel blackish brown lines, a minute brown dot at end of cell, cilia brown; hind-wing with a distinct, median, slightly curved, dark brown transverse line; both wings beneath with a transverse median brown line.

Expanse 27 mm.

Natal: Durban (*Col. Bowker*).

Differs from typical *Chilena* in vein 8 of hind-wing anastomosing with vein 7 from its origin.

♂ Bombycopsis conspersa, n. sp.

(Plate XVI, fig. 4.)

♂. Yellowish, thorax above darker greyish yellow; fore-wing greyish flesh-colour suffused with fuscous grey, with two nearly straight transverse pale lines, one before middle very indistinct, the other beyond apex of cell distinct and followed on outer side by a broad fuscous grey transverse diffused band; a very broken submarginal fuscous line terminating on inner side the marginal area, which is densely suffused with olivaceous grey, no dot at end of cell, the cell, darker than the surrounding parts; hind-wing pale yellowish with an obsolescent pale flesh-coloured transverse shade in the middle. Wings below ochreous yellow, slightly suffused with brownish or fuscous at costal margins.

Expanse 45 mm.

Brit. East Africa: N'gong (*R. C. Crawshay*).

Nearly allied to *Bombycopsis indecora*, Walk., and *B. venosa*, Butl., and somewhat intermediate between

these two species. *B. conspersa* is larger than *indecora* and has a yellowish and not a grey ground-colour; from *venosa* it differs in having the thorax and the fore-wings much darker and suffused with grey or fuscous; the veins are not so distinctly yellow as in *venosa*.

Olyra rectilineata, n. sp.

(Plate XVI, fig. 7.)

♀. Dark reddish brown; abdominal segments above with pale hind marginal borders; fore-wing above with two entirely straight and erect transverse parallel pale yellowish lines, one before the other behind middle, an irregular submarginal series of short yellowish erect lines between the veins; hind-wing with a fine yellowish line from costal margin at least to end of cell (sometimes obsolete); fore-wing below much paler yellowish, reddish brown at apex and at termen; hind-wing below reddish brown with two, in the middle very angulate, transverse, pale yellowish lines.

Expanse 39–40 mm.

Gazaland: Mt. Chirinda (*G. A. K. Marshall*), December. Mashonaland (*Dobbie*).

Two females, one in Brit. Museum, one in Museum Holmiæ.

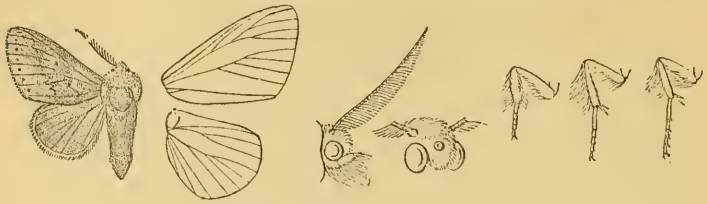
Haplopacha, nov. gen.

Palpi entirely hidden by long hairs; frons with slight corneous prominence. *Antennæ* of male bipectinate to apex; branches moderately long. Head, thorax and legs clothed with hairlike scales. Fore-legs slender, unarmed; middle and hind tibiæ with two apical spurs. *Abdomen* short not reaching beyond tornus. *Cell* of both wings open. *Fore-wing* short, triangular; vein 2 from behind middle of cell, slightly curved, 3 from slightly nearer to 4 than to 3, 4 and 5 from hind angle, 6 and 7 stalked, 8 from the long stalk of 9 and 10, 9 running to termen near apex. *Hind-wing* short, obtuse; costal margin nearly straight; vein 2 from middle of cell, 3 nearer to 4, 4 and 5 from the same point, 7 well separated from 8, 8 anastomosing with cell near base, forming a very narrow pre-costal cell, one thick, curved accessory veinlet at base.

A very distinct genus, allied to *Chondrostega* and *Chondrostegoides*, but differing from both in vein 8 of fore-wing being emitted from the long stalk of 9 and 10 and vein 8 of hind-wing not anastomosing from base with the cell, but forming a narrow precostal cell.

Haplopacha cinerea, n. sp.

♂. Cinereous grey ; fore-wing with two obsolete transverse fuscous lines or shades, a dark dot at end of cell and a submarginal series of



Haplopacha cinerea, ♂ ½.

black dots ; hind-wing on both sides and fore-wing below unicolorous fuscous grey. Antennæ with the branches yellowish-brown.

Expanse 26 mm.

Rhodesia : Sebakwe.
A single, rather badly damaged specimen.

Chondrostegoides, nov. gen.

Palpi very minute. *Eyes* small, hairy. *Antennæ* bipectinate to tip in both sexes, branches rather long in male, shorter in female. *Frons* with a conical corneous prominence, short in male, much longer in female. *Fore tibiæ* normal, unarmed ; *middle* and *hind tibiæ* without spurs. *Cell* of both wings open. *Fore wing* with costal and hind margins straight, outer margin regularly curved ; vein 3 from middle between 2 and 4, 6 and 7 stalked, 8 free from middle between 7 and 9+10, 9 and 10 stalked both running to termen, 11 to apex. *Hind-wing* with vein 3 from middle between 2 and 4, 8 entirely anastomosing with cell to middle between base and vein 7, two short accessory veinlets at base.

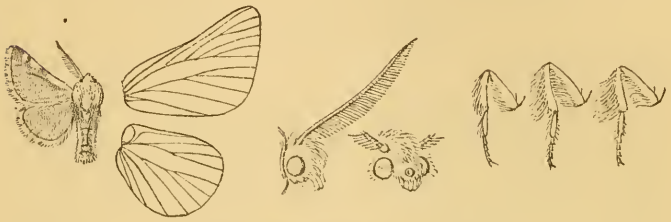
Nearly allied to *Chondrostega* (Led.) differing, in the normal, unarmed tibiæ and the winged female. Frons with a single conical prominence only.

Chondrostegoides capensis, n. sp.

♂. Ashy-grey, fore-wing above, with two white spots at costal margin near apex, cilia of both wings chequered with whitish ;

under-side of fore-wing fuscous grey, with three white spots at costal margin near apex separated by blackish streaks ; under-side of hind-wing white, a spot at base of costa, the cell and the base of the areas 2–4 brown ; two angulated blackish lines across the middle, inner line indistinct in the cell.

Expanse 18 mm.



Chondrosteyoides capensis, ♂ ½.

♀. Unicolorous, dark grey. Hind-wing below with an obsolescent fuscous median band. Abdomen without terminal tuft.

Expanse 22 mm.

Cape Colony : Deelfontein, October.

The male is in beautiful condition, but the female is rather rubbed.

Explanation of Plate XVI.

Fig. 1. *Pseudometa patagiata.*
2. *Philotherma sordida.*
3. *Gonometa regia.*
4. *Bombycopsis conspersa.*
5. *Anadiasa cervina.*
6. *Beralade simplex.*
7. *Olyra rectilineata.*
8. *Taragama fusca.*
9. *Beralade bettoni.*
10. *Gastroplakæis rufescens.*
11. *Taragama capensis.*
12. *Lechriolepis pulchra.*
13. *Taragama distinguenda.*
14. *Beralade continua.*

XIX. *Memoir on the* Rhynchota *collected by* Dr. Arthur Willey, F.R.S., *chiefly in Birara* (*New Britain*) *and Lifu.* By G. W. Kirkaldy, F.E.S.

[Read June 7th, 1905.]

Plate XVII.

Although of an extremely interesting character, the collection of *Rhynchota* made by Dr. Willey * is too small, and too many of the forms described from neighbouring localities are as yet insufficiently known to me, to render a discussion upon their geographical distribution profitable. However, as might have been expected, the Rhynchotal fauna of Lifu partakes very closely of the nature of that of New Caledonia, while that of Birara is equally intimately related to the fauna of Papua (or New Guinea), at the same time all these are closely interrelated. Throughout I have employed the terms Lifu and Birara, as it appears expedient to retain the native names of such islands wherever these are distinctive, except those which are extensively colonized by Europeans, as, for example, New Zealand and even New Caledonia. Birara (also spelt Berrara) was formerly known as New Britain, and it was under this term that the bulk of Dr. Willey's researches have been published. The present official term, since the acquisition of the group by Germany, is Neu Pommern (or New Pomerania). The island of Murua, frequently alluded to in the following pages, is also known as "Woodlark" and is termed "Moiou" by Montrouzier.

The chief difficulty in the specific determination of this fauna as regards the *Rhynchota*, is its close relationship with that of Papua (or New Guinea), the latter being as yet very imperfectly known, the latest descriptions dating in some cases from Guérin-Meneville's contribution to the "Voyage of the Coquille," and Boisduval's

* This Memoir may be regarded as a supplement to the "Zoological Results based on material . . . collected by Dr. Willey," published in five volumes by the Cambridge University Press, 1898–1902.

volumes on the "Voyage of the Astrolabe." The examination of large series of *Rhynchota* from the multitude of islands comprising the Bismarck, Solomon, New Hebrides, and Loyalty Archipelagoes would be exceedingly interesting from a distributional point of view. Our principal knowledge of these faunas is derived from the works of Montrouzier (or Montrousier as he also terms himself), a French priest, who resided in New Caledonia and the surrounding islands for many years. Dr. Willey has collected some seventy-six species, falling into sixty-five genera. Of these I have described as new five genera, one subgenus, twenty species and one variety, but the principal interest of his labours lies in the large proportion of immature forms, the consideration of which is reserved for a future paper.

My thanks are due to Mr. W. L. Distant, for kindly assistance in the determination of several species, and for help with the proofs in my absence from England; and to Dr. D. Sharp for allowing me the opportunity of examining so interesting a collection.

Sub-order HOMOPTERA.

Family CICADIDÆ.

Genus UEANA, Dist. Ann. Mag. Nat. Hist. (7), xvi, p. 28.

Dr. Willey has collected fourteen specimens, which I have ventured to divide into two species—though somewhat doubtingly—neither of which can I refer to *Cicada lifuana*, Montrouzier, though one of them is certainly the *Ueana lifuana* as identified by Distant.

1. UEANA LIFUANA, Montr.

(?) *Cicada lifuana*, Montr., 1861, Ann. Soc. Ent. France, 4, 1, p. 70.

Ueana lifuana, Dist. Ann. Mag. Nat. Hist. (7), xvi, p. 29.

Montrouzier says, "Veines de la première moitié des elytres vert-bleu. Elytres irisées,". . . . which does not in the least apply to any of the specimens before me. Montrouzier records it from Lifu.

2. Ueana harmonia, sp. nov.

(Plate XVII, fig. 1.)

(?) *Tibicen* (?) *lifuana*, Dist., 1883, P. Z. S., p. 190.

Pale luteous, markings on head and pronotum, lateral third of scutellum, a W-mark on anterior margin of scutellum, abdomen above at base—pale luteo-ferruginous; posterior margin of pronotum pale luteous. Costa, except lateral margin and basal nervures, pale luteous; lateral margins of costa very narrowly, basal cell and apical nervures fuscous. Tegmina immaculate. Ocelli yellow.

♂. Rostrum reaching scarcely beyond base of posterior coxæ; opercula larger, distinctly reaching well beyond apical margin of 1st (? 2nd) abdominal segment—genital segment apically narrowed, acutangular. Metasternal process, roundly and smoothly tubercular.

♀. Opercula smaller, not reaching to apical margin of first segment. Ultimate segment acute.

Long. 23½ mm. Expanse of tegmina 61 mm.

Lifu (Willey).

3. Ueana polymnia, sp. nov.

(Plate XVII, fig. 2.)

(?) *Tibicen* (?) *lifuana*, Dist., l. c.

Darker, the luteous replaced by furruginous on head, pronotum and abdomen, except posterior margin of, and longitudinal stripe on, pronotum, etc.

♂. Rostrum reaching to apex of posterior coxæ. Opercula smaller, not reaching to apical margin of 1st segment. Metasternal tubercle smaller, not smooth. Genital segment not apically truncate or slightly rounded.

♀. Opercula as in ♂.

T. polymnia thus seems to differ—beyond coloration—by the longer rostrum, the larger opercula (at least in the male), the differently formed metasternal tubercle, and the stronger nervures.

While in some specimens the ulnar nervures are quite contiguous close to the base, they are clearly apart in others. Distant records "*T. lifuana*" from New Caledonia.

Genus Bæturia, Stål.

Bæturia, Stål, 1866, Hem. Afr., IV, p. 9.

Distributed through the Malayan Archipelago and the South Pacific Ocean.

1. B. EXHAUSTA, Guérin.

Cicada exhausta, Guérin, 1838, Voy. Coquille, p. 181. [Plate 10, fig. 6 (1831).]

Bæturia exhausta, Distant, Orient. Cic., p. 149. Pl. 15, fig. 13.

BIRARA (Willey); also recorded from New Guinea, Amboina, Ceram and Buro (Distant); Ternate and Uliasser (Breddin).

Genus DUNDUBIA.

Dundubia, Amyot and Serville, 1843, Hémiptères, p. 470.
Cosmopsaltria, Stål, Hem. Afr., IV, p. 5.

Distributed throughout Oriental and Australian regions.

DUNDUBIA OBTECTA, Fabr.

Tettigonia obtecta, Fabricius, 1803, Syst. Rhyng., p. 35.
Cosmopsaltria obtecta, Distant, Orient. Cic., p. 67. Pl. 5, fig. 13.

BIRARA and LIFU (Willey); I have also seen it from Ternate, Batchian, Amboina and Aru, and Distant further records it from Salawati, Halmahera (or Jilolo), Ceram, and Duke of York Island (in the Bismarck Archipelago, I presume); Obi (Breddin).

Family CERCOPIDÆ.

Genus CLOVIA.

Clovia, Stål, 1866, Hémipt. Afr., IV, p. 68.

Distributed over the Ethiopian, Oriental and Australian regions.

CLOVIA BIRARENSIS, sp. nov.

(Plate XVII, fig. 3.)

Closely allied to *C. separata*, Walker, but differing in pattern, which seems constant.

Shining black, whole surface covered with short yellowish pilosity, more thickly on the vertex. The posterior margin of vertex and a slightly rounded stripe connecting the intero-apical ocular angles;

a sub-anterior stripe across pronotum (not reaching lateral margin); a stripe reaching from posterior angle of scutellum across clavus and corium, narrowing outwardly and not quite reaching externo lateral margins of corium; a slightly curved stripe from externo lateral margins of corium—a little posterior to the stripe last described—almost to apex of tegmina (roughly at right angles to the clavo-corial stripe); a stripe (broadening posteriorly) from postero lateral angle of mesopleura, running sublaterally beneath the eyes and round the antero-lateral margin of the frons, bright yellow. Lateral margins of posterior third of tegmina exteriorly, and posterior half internally, brownish hyaline; abdomen above and connexivum beneath dark brownish; wings brownish hyaline. Frons, clypeus, rostrum, anterior legs and intermediate and posterior tibiæ, abdomen more or less, ferruginous. Sterna, coxæ, posterior femora, pale yellow. Spines and tarsi black. Genæ, except the yellowish parts, black; a sublateral stripe on mesopleura interior to the yellow, and apex of rostrum black. Head slightly declivous. Frons much swollen, rostrum reacting to apex of mesocoxæ. Ocelli very slightly nearer to one another than to the eyes. Pronotum and tegmina strongly and closely punctured, the former somewhat convex, nearly twice as long as the head. Tegmina rounded laterally, apically subrotundately acute.

♂. Genital plate long.

♀. Valves five or six times as long as the last abdominal segment.

Long. 12–12½ mm. Breadth across pronotum 4 mm.; across tegmina 5¾ mm.

Hab. Birara (Willey).

Var. The scutellum may be either partly or entirely ferruginous.

Clovia dryas, sp. nov.

Pale ferruginous. Vertex and pronotum with similar markings to *C. birarensis*, but apical margin of vertex (to eyes) also pale yellowish. Anterior margin of scutellum pallid. Tegmina similarly marked to *C. birarensis* except that the clavo-corial stripe practically reaches the extero-lateral margin, the apical stripe is straighter, and these marks are clouded exteriorly with dark brownish, instead of being clear-cut as in *C. birarensis*. Beneath paler ferruginous, the yellow stripe in *C. birarensis* only faintly indicated here. Anterior tibiæ and all the tarsi blackish. Head with eyes wider than the pronotum; head and pronotum not or scarcely convex. Surface of frons much flatter than in the other species. Pronotum striate-punctate, very slightly longer than vertex. Ocelli a little closer

together than to the eyes. Tegmina more parallel-sided, striate-punctate.

Long. 10¼ mm. Width 3 mm.

Hab. Birara (Willey).

Genus Aufidus, Stål.

Aufidus, Stål, Trans. Ent. Soc. London, 1863, p. 594.

Aufidus hyperion, sp. nov.

(Plate XVII, fig. 4.)

Allied to *A. tripars* (Walker).

Head, thorax and basal third of tegmina, ventral surface, legs, abdomen, etc., stramineous. Base of frons proper, extreme apex of vertex, a small spot enclosing each of the ocelli, eyes, tarsi apically, exterior margin of anterior tibiæ, black. Apical two-thirds of tegmina (except lateral margin of their basal two-thirds) blackish fumate. Posterior margin of pronotum widely (except postero-lateral angle) and pallid parts of tegmina, suffused with sanguineous. Abdomen above, femora and posterior tibiæ more or less sanguineous. Tegmina and pronotum posteriorly yellowish pilose ; head and pronotum anteriorly blackish pilose. Frons swollen, medianly flattened and sulcate ; rostrum apically black, reaching a little beyond the base of intermediate coxæ.

Long. 10½ mm. to apex of tegmina. Breadth 3 mm.

Hab. Birara (Willey).

The abdomens of the two specimens (1 ♂ 1 ♀) are unfortunately a little distorted by alcohol.

Family TETTIGONIIDÆ.

Genus Tettigonia, Geoffr.

Tettigonia, Geoffroy, 1762, Histoire abrégée, I, p. 429.
Tettigonides (part), Signoret, Ann. Soc. Ent. France, 1853, p. 13.

The most satisfactory arrangement of this huge genus or collection of genera yet made is that by E. D. Ball, but it only applies, unfortunately, to North American forms. So little is known of the Asiatic and Australian

species that I have preferred to describe fully, as a *Tettigonia* the following interesting form, which appears to be so far unknown. *Tettigonia* in its wide sense is practically cosmopolitan.

T. WILLEYI, sp. n.

Head, thorax, and abdominal sternites, rostrum and legs, testaceous, abdominal tergites a little darker. A black elongate spot on each side of the middle line of the head, at the junction of frons and vertex almost meeting in the middle and extending laterally as far as the antennal ledges ; also a black spot immediately posterior to each ocellus reaching from thence almost to the base of the vertex. Apical margin of pronotum medianly black, also a number of blackish-brown spots on the anterior quarter of pronotum ; scutellum with a sublateral longitudinal black stripe on each side. Tegmina dark purplish brown, interior fourth of membrane hyaline, more or less fumate. Wings purplish brown, fumate. Anterior intermediate tarsi more or less fuscous, anterior tibial bristles black. Abdomen above medianly blackish. Head triangular, sub-convex, apically acutangular ; vertex and pronotum forming an obtuse angle at their junction. Seen laterally, the head from base of eye to apex of vertex is distinctly longer than the pronotum ; the antennal socket is protected by a somewhat strong ledge, part of which is distinctly visible from above, interrupting the curve of the head. Ocelli large, about twice as far apart from one another as from the nearest eye. Base of vertex roundly emarginate, carinately margined through its entire breadth. Frons slightly swollen, the surface flattened, somewhat obsoletely granulate. Anterior tibiæ not (or exceedingly slightly) dilated, not sulcate. First segment of posterior tarsi longer than the other two together. Head and eyes scarcely so wide as the base of pronotum. Vertex between the eyes two-thirds wider than the eyes together. Pronotum quadrilateral, anterior margin rounded, posterior margin slightly obtusangularly emarginate. Pronotum obsoletely impressed transversely at its anterior third ; strong and finely punctured (on posterior two-thirds at least). Elytra extending far beyond apex of abdomen, apically rounded.

♂. Male plates much longer than the ultimate abdominal segment, apically angular, the extero-lateral margins rotundate basally, obliquely subtruncate apically, provided with short bristles basally near the lateral margins. Pygofers dark, more than twice as long as the plates, bristly.

♀. Ultimate abdominal segment bisinuate apically, valves about four times as long as the preceding, bristly.

Long 8·4 mm. to apex of abdomen, 9·8 to apex of tegmina, width across pronotum 2·3 mm.

Hab. Birara (*Willey*).

Thalattoscopus, gen. nov.

(Plate XVII, fig. 5.)

Very similar to *Bythoscopus*, Germ. (=*Macropsis*, Auctt.), but frons, clypeus and genæ anastomosed or only obsoletely sutured off. Postmargin of eyes beneath, emarginate. Apical margin of head widely rounded. *Ocelli* distant about two and a half times as far from each other as from the eyes. *Vertex* very short, seven or eight times as wide between the eyes as long, about twice as wide as the eyes together, acutely margined basally. Antennal ledge truncate. Pronotum and scutellum very distinctly transversely striated, pronotum at base slightly wider than the eyes, lateral margin somewhat rounded.

T. dryas, sp. nov.

(Plate XVII, fig. 5.)

Above pale luteous, beneath testaceous. Eyes reddish-brown. Apical margin of vertex widely rounded, rostrum slightly passing anterior coxæ. Anterior and intermediate femora incrassate, posterior femora a little dilated, tibiæ subobliquely flattened, sulcate beneath. First segment of posterior tarsi equal to the other two together. Tegmina reaching well beyond apex of abdomen.

♀. Valves four times as long as preceding segment, exteriorly subrotundate, five-eighths longer than maximum width, each valve apically subacute, covered sparsely with short, pale luteous, bristles.

Long. 10½ mm. to apex of tegmina, 9 to apex of abdomen, width 3¾ mm. across base of pronotum.

Hab. Birara (*Willey*).

Family FULGORIDÆ.

Genus Phyllyphanta, Am. Serv.

Phyllyphanta, Amyot and Serville, 1843, Hémiptères, p. 523. Melichar, 1902, Ann. Hofmus. Wien, XVII, p. 54.

Cromna, Walker, 1857, Journ. Linn. Soc. Lond., I, p. 85.

Distributed over the Southern Oriental Region and Malayan Isles.

P. BIRARÆ, sp. nov.

Allied to *P. producta* (Spinola), but smaller and differs as follows:—

Apparently immaculate. Frons distinctly carinate along the middle. Pronotum and scutellum distinctly 3-carinate. Tegmina narrower, intero-apical angle somewhat obtuse—not strongly acute as in *P. producta* (Spin.) and *P. dubia* (Kirby).

Preserved in alcohol and not in good condition.

Long. 7 mm. (exclusive tegmina); 11½ mm. (with tegmina); expanse about 23½ mm.

Hab. BIRARA (*Willey*).

Genus EURICANIA, Melichar.

Euricania, Melichar, 1899, Ann. Hof. Wien, XIII, p. 255.

Distributed over the Oriental region up to Japan and over the Pacific Islands.

E. SPLENDIDA, Fabr.

Flata splendida, Fabr., 1803, Syst. Rhyng. p. 50.
Ricania splendida, Guérin, 1838, Voy. Coquille, p. 191, [Pl. 10, fig. 10 (1831)].
Euricania splendida, Melichar, 1899, Ann. Hofmus. XIII, p. 262 (Pl. 10, fig. 8).

Hab. BIRARA (*Willey*), two examples without the white tegminal spots; also recorded from New Guinea, Dorei, Triton Bay, Kimgunan, Meisol, Key and Sula (*Melichar*).

Genus TARUNDIA, Stål.

Tarundia, Stål, 1859, Berlin Ent. Zeit. III, p. 325; Melichar, 1899, Ann. Hofmus. Wien, XIII, p. 265.

Distributed over South Africa, the smaller Mascarene Islands, New Guinea, the Solomons Islands.

T. GLAUCESCENS, Melichar.

Tarundia glaucescens, Melichar, 1899, Ann. Hofm. Wien, XIII, p. 267.

Hab. BIRARA (*Willey*), also recorded from New Guinea.

HAJAR, gen. nov.

Allied to *Tarundia*, Stål, and *Pochazina*, Melichar, but distinguished by the basal cell emitting four nerves and by a different disposition of basal nerves.

Frons not narrower than long, lateral margins of clypeus not carinate, laterally rounded, subperpendicular. *Tegmina* wide trilateral. The two claval nerves uniting at the middle of the clavus; six or seven tranverse nerves in clavus; great claval nerve uniting with the claval margin at the apex of the clavus. Radial and subradial veins springing at the same point from the basal cell, both running subparallel as far as stigma. *Costal membrane* much wider than costal area, slightly arched exteriorly, several of the costal nervures furcate. Longitudinal nerves in corium somewhat far apart, few transverse nervures. Those always simple. Interior ulnar nerve arising out of the basal cell at the opposite apical angle to the exterior ulnar nerve.

Hajar fornicatus, sp. nov.

Pale luteo-testaceous (greenish ?). Abdomen with some black spots dorsally; a few of the transverse corial nerves fumate. Tegmina a little longer than wide, apically rounded. Vertex a little produced, truncate apically, lateral margins carinate, at right angles to apical margin, posterior margin excavated, pronotum short, but strongly carinate medianly longitudinally. Scutellum tricarinate the lateral keels meeting the middle keel apically at an acute angle. Frons obscurely carinate longitudinally, strongly carinate laterally and apically. Posterior tibiæ with two spines.

Long. 5·2 mm. to apex abdomen; expanse tegmina 18 mm.

Hab. Birara (*Willey*), 1 ♀ damaged by alcohol.

Peggioga, gen. nov.

Allied to *Dictyophara*, Germ., but differs by the acutangularly emarginate bases of head and pronotum, the numerous transverse nervures in the very narrow costal membrane, and the less reticulate apical third of tegmina. *Frons* tricarnate, *clypeus* very short, strongly tricarinate, *posterior tibiæ* 3-spinose. *Anterior femora* unarmed.

Peggioga formosa, sp. n.

(Plate XVII, fig. 6.)

Stramineous (greenish ?); apex of head black, median line of the various keels of the head, pronotum, scutellum, and elytral nervures, more or less pale ferruginous. Stigma, intero-apical margin of tegmina, exterior half of the transverse series of nerves leading from the stigma, and the nerves in the costal membrane (and the nerves

in the dark apical part aforementioned) blackish-brown or blackish. Apex of femora and base of posterior tibiæ very narrowly blackish. Abdomen above more or less blackish.

Vertex subfiliform, apex subrotundate-truncate, $2\frac{1}{3}$ times as long as width of head including eyes—more than twice as long as scutellum—slightly compressed medianly, as wide between the eyes as the length of an eye (as seen from above), one-third wider than the eyes together. Posterolateral margin of pronotum truncate, at right angles to the insect's longitudinal plane ; at its meeting with the convex lateral margins of scutellum, it abruptly turns forward at an obtuse angle, the two sides almost meeting at a right angle when they abruptly turn forward again acuminately ; between the posterolateral angle and the apex of pronotum it is medianly and strongly elevately carinate. The upper lateral margins are roundly sinuate and do not quite reach the base, the lower lateral margins commence carinately close to the eyes and reach the posterolateral angle acuminately. Lateral part of scutellum between lateral margins and the exterior keels is strongly punctured. Interior (great) claval nerve meets the commisural vein almost at the same place as it meets the claval sutural vein, forming a very long narrow cell. Basal cell elongate gives off three nervures, the radial and subradial arising at the same spot and proceeding somewhat divergingly to the transverse veins, a little before which the radial forks ; the ulnar nerve arises at the opposite apical angle of the cell and continues to the transverse veins, forking a little before them. All the apical veins are furcate, sometimes reuniting ; all the veins are shortly, somewhat sparsely, pilose. Rostrum reaches the base of posterior coxæ.

Long. to apex of abdomen 13 mm., to apex tegmina 17 mm., expanse tegmina $24\frac{1}{2}$ mm.

Hab. Lifu (*Willey*).

Sub-order HETEROPTERA.

Family CAPSIDÆ.

Imogen, gen. nov.

Elongate. Head vertical, shining, polished, smooth, logitudinally impressed near the base. Eyes shortly pedicillate and very prominent, nearly twice as broad in profile as high, posterior margin sinuate. Antennæ inserted close to the inner angle of the eye, first segment a trifle shorter than the profile-width of the eye. Second incrassate towards the base, third segment very slender. Pronotum

smooth, shining, and polished, deeply impressed and constricted in the middle, with a distinct annuliform collar, lateral margins of anterior lobe rotundate, obtusangular, not reaching laterally as far as the eyes, subtuberculate. Posterior lobe laterally subcarinate, straight, widely diverging posteriorly. Scutellum smooth, shining, anteriorly depressed. Elytra long, subparallel, clavus and corium coarsely and thickly punctured; cuneus somewhat deeply excised, much longer than wide; membrane with two cells. Femora not incrassate; third segment of posterior tarsi longer than the other two together.

This genus probably belongs to the *Capsaria*, but has apparently no near relations.

IMOGEN FORMOSA, sp. nov.

Head above and beneath (except at base of vertex), basal two segments of antennæ, posterior half of scutellum, elytra, posterior margin of pronotum except medianly, basal two segments of rostrum, abdomen above and beneath, sterna more or less, femora, etc. blackish or blackish-violet. Base of vertex, pronotum, anterior half of scutellum, propleura, etc., apical two segments of rostrum, yellowish-orange; anterior tibiæ, tarsi and third segment of antennæ pallid yellow. Posterior tibiæ and tarsi black annulated with whitish. Vertex, between the eyes, about two-sevenths wider than the two eyes together. Rostrum reaching to about the middle of the mesosternum. Second segment of antennæ three times as long as the first which is two-fifths longer than the third.

Long. 5 mm. (to apex of elytra 6 mm.). Breadth 2 mm.

Hab. BIRARA (*Willey*).

Family NAUCORIDÆ.

Genus MONONYX, Laporte.

Mononyx, Laporte, 1832–3, Essai, p. 16; Montandon, 1899, Bull. Sci. Bucarest, VIII, nos. 4 and 5, pp. 4 and 5.

Not found in America, north of Mexico; or in the Palæarctic Region.

M. MIXTUS, Montandon.

Mononyx mixtus, Montand., op. cit. p. 15.

Hab. Birara (*Willey*); also recorded by Montandon from Australia, Amboina, and New Guinea.

Family NOTONECTIDÆ.

Enithares, Spinola.

Enithares, Spin., 1837, Essai, p. 60.

Distributed over Australian, Ethiopian, and Oriental Regions. Also in Brazil.

Enithares, sp. nov.

A new species, scarcely in sufficiently good condition to characterize, allied to *E. abbreviata*, Kirby.
Hab. Birara (*Willey*).

Family REDUVIIDÆ.

Genus Polydidus, Stål.

Polydidus, Stål, 1858, O. V. A. F., p. 448.

A few species distributed over Oriental, Australian, and Ethiopian Regions.

Polydidus armatissimus, Stal.

Polydidus armatissimus, Stål, 1859, O. V. A. F., p. 376.

Hab. Birara (*Willey*); also from India, Ceylon, China, and the Philippines.

Genus Physoderus, Westwood.

Physoderus, Westwood, 18, Journ. Proc. Ent. Soc. Lond., 1844, p. cxv.
Epirodera, Westwood, 18, Trans. Ent. Soc. Lond., 1847, p. 247; Leth. and Sev., l. c., III, p. 96.

Madagascar, Philippines, and the Indomalayan Islands.

Physoderus azrael, sp. nov.

Belongs to Stål's div. *a*.

Head, pronotum, scutellum (except the produced posterior part), membrane, sterna (in great part), dark purple-brown, almost black, dull. Scutellum posteriorly, abdomen above, etc., clear luteous. Coriaceous part of elytra fulvofuscous. Connexivum blackish, spotted with luteous. Abdomen beneath sordid yellowish-brown with two sublateral (or submedian) subparallel longitudinal lines formed of blackish-brown spots, the spotted connexivum forming a third line. Legs pale, sordid yellowish-brown, somewhat obscurely annulated with dark brown. Antennæ pallid yellowish-brown.

Long. 8 mm.

Hab. Birara (*Willey*).

Genus Darbanus, Am. Serv.

Darbanus, Am. Serv., 1843, Hémipt., p. 370.
Euagoras, Leth. Sev., l. c., III, p. 184.

Distributed over the Oriental and Malayan Islands.

D. dolosus, Stål.

Euagoras dolosus (Stål), 1863, Ann. Soc. Ent. France, p. 28.

Hab. Birara (*Willey*); Ké Island (*Stål*); Aru (*Distant*).

Genus Oncocephalus, Klug.

Oncocephalus, Klug, 1830, Symb. Phip., p. 2, almost world-wide in distribution.

Oncocephalus amen, sp. nov.

♂. Apparently allied to *O. assimilis*, Reuter, but differing by the proportions of the antennæ, pronotum, etc. Elongate, sordid testaceous, head with a large black spot on the posterior area, pronotum with three double longitudinal lines which are fainter on the posterior area. Scutellum with a pallid irregular central longitudinal line. Head, pronotum, and abdomen irregularly marked with black laterally. Antennæ pallid, apex of first and of second segments black, third and fourth fumate. Apex of the second and third rostral segments black. Anterior and intermediate legs pallid, anterior femora banded irregularly with brown beneath, anterior and intermediate tibiæ with three blackish rings; intermediate femora apically black. Posterior femora brownish-black, a little clouded with pallid; posterior tibiæ pallid, with two brownish rings near the base. Elytra brownish testaceous, obscurely irrorated with brownish, with two large velvety blackish-brown spots, the apical one with

a whitish wedge anteriorly. Head long and narrowed in profile, anterior spines not very prominent; anterior area and first segment of antennæ subequal in length, the former distinctly longer than the posterior area plus the eyes. Second segment of antennæ one-third longer than the first, 2¾ longer than the third, and a little more than twice as long as the fourth; first segment glabrous, second slender. Eyes beneath strongly convergent, width of eye (as seen from beneath) about three times (or more) as wide as the intraocular space. Gula not tuberculate. Rostrum incrassate, first segment reaching to anterior margin of eye. Eyes very large, occupying almost the entire width of the head in profile. Anterior lobe of pronotum destitute of discal spines, anterior angle minutely spinose. Pronotum about the middle of the lateral margins with a small tubercle, a little posterior to this somewhat deeply impressed transversely; the lateral margins of the anterior area are subparallel, of the posterior area widely divergent. Posterolateral angles acute, subvertical, not extending anteriorly beyond apical margin of posternum. Scutellum distinctly recurved posteriorly. Anterior femora, with a single row of eleven to twelve small spines inferiorly, trochanters with two or three small spines. Posterior tibiæ slightly pilulose, distinctly longer than femora.

Long. 15 mm.

Hab. Birara (*Willey*).

Luteva, sp. nov.

Genus Luteva, Dohrn.

Luteva, Dohrn., Linn. Ent., XIV, pp. 213 and 242.

Two or three specimens in indifferent condition from Lifu, probably referable to a new species.

Family GERRIDÆ.

Genus Gerris, Fabricius.

Gerris, Fabr., 1794, Ent. Syst., IV, p. 188.
Limnometra, Mayr., 1866, Novara Reise, Hem., p. 174.

Cosmopolitan; the subgenus *Limnometra* occurs in every region except the Palæarctic.

Gerris, sp. (?).

Hab. Birara (*Willey*).

Family NEPIDÆ.

Genus RANATRA, Fabricius.

Ranatra, Fabr., Syst. Rhyng, p. 108.
Cercotmetus, Amyot and Serville, Hist. Hém., p. 441.

Practically cosmopolitan.

RANATRA PARMATA, Mayr.

Ranatra (*Cercotmetus*) *parmata*, Mayr., Novara Reise, p. 192; Fab. V, f. 60.

Hab. JAVA, TJIBODAS (*Willey*).

Family ARADIDÆ.

Genus BRACHYRHYNCHUS, Lap.

Brachyrhynchus, Laporte, Essai, p. 54.

Almost world-wide in distribution.

BRACHYRHYNCHUS TAGALICUS, Stål.

Aristus tagalicus, Stål., 1870, O. V. A. P., p. 672.

Hab. BIRARA (*Willey*), also recorded from Philippines, Burma, Java and Nias Island.

BRACHYRHYNCHUS MEMBRANACEUS, Fabr., var. BRACHYRHYNCHUS ORIENTALIS, Laporte.

Aradus membranaceus, Fabr., 1803, Syst. Rhyng, p. 118.
Var. *Brachyrhynchus orientalis*, Lap.

Hab. BIRARA (*Willey*); also recorded from South Oriental region, New Guinea, Vanikoro, etc.

Genus NEUROCTENUS, Fieber.

Neuroctenus, Fieber, 1861, Europ. Hem., p. 34.

Similar distribution to *Brachyrhynchus*, except the Palæarctic Region.

NEUROCTENUS, sp. (?).

Two specimens in indifferent condition (*Willey*)

Family PYRRHOCORIDÆ.

(= *Pyrrhocoridæ* + *Lygæidæ*, Leth. and Sev.)

Genus PHYSOPELTA.

Physopelta, Ann. Serv., 1843, Hémiptéres, p. 271.
Iphita, Stål, 1870, Sv., Akad. Handl., 9, No. 1, p. 99.

Distributed through the Oriental, Ethiopian, and Australian Regions.

PHYSOPELTA FIMBRIATA, Stål.

Physopelta fimbriata, Stål, 1863, Berl. Ent. Zeit., VII, p. 392.

Hab. BIRARA (*Willey*); previously recorded from Timor.

P. FAMELICA, Stål.

Physopelta famelica, Stål, 1862, Berl. Ent. Zeit., VII, p. 391.
(?) *Lygæus woodlarkianus*, Montr., 1855, l. c., p. 105.

Hab. BIRARA (*Willey*); recorded also from Australia, New Guinea, Ceram, etc., scarcely distinguishable from *P. gutta*, Burm.

DYNAMENAIS, gen. nov.

Allied to *Æschines*, but distinguished by the glabrous abdomen and prominent eyes; also allied to *Ectatops*, Bo., distinguished by the form of the head, the much more prominent bucculæ and the glabrous abdomen.

Head almost vertical in the front of the eyes, transversely impressed behind them but not narrowed; eyes large and very prominent, shortly stylate, projecting above the surface of the vertex, as seen in profile; base of eyes touching or slightly overlapping pronotum. The base of the head between the eyes is also sulculate, slightly obtuse angulately emarginate. Pronotum, with a well-marked collar, divided from the anterior area by a punctured deeply impressed line, anterior area separate from posterior area by a very deeply impressed line, also punctured. Lateral margins and pronotum subvertical. The collar and the lateral margins are smooth and polished, the rest of the pronotum is dull and sparsely punctured, except the posterior margin which is polished and sparsely punctured. First segment of antennæ longer than second and third together and longer than fourth. Bucculæ very prominent, acute. First

segment of rostrum reaches to the base of head, or at least not beyond base of collar. Stink-gland orifices with a short sulcus, reaching along half the width of the pleuron, but very distinct; margins curved, callose. Wings with a hamus. Legs unarmed. Abdomen glabrous beneath.

Dynamenais venustus, Walker.

Ectatops venustus, Walk., 1873, Cat. Hem., VI, p. 17.

Dull black, marked with yellowish white. Head, except apex; pronotum, except collar, lateral and posterior margins; scutellum; elytra, except costal margin, and the apical margin of corium—the latter widely—and the apical margin of membrane; antennæ, except extreme base of first segment, and basal two-thirds of the fourth; first segment of rostrum; basal two-thirds of the femora; apical abdomen tergites; sterna and pleura, the collar and the posterior margin of pro- and metapleura excepted; ambulacra; basal half of abdominal sternites in the middle and one or more of the other abdominal sternites entirely; black more or less dull, except the more or less shining abdominal segments, the above exceptions are all more or less yellowish-white except the sanguineous abdominal tergites. Second, third and fourth rostral segments castaneous-brown; tibiæ and tarsi pallid or brownish. The prominent parts of the bucculæ are ivory-white. Head dull, somewhat obscurely rugulose, first segment of antennæ a little more than twice as long as the second, and one-sixth longer than the fourth; second one-third longer than third. First rostral segment a trifle longer than the second; the fourth reaching a little beyond the posterior coxæ. Lateral margins of pronotum sinuate; posterior margins of pro- and metapleura, and the ambulacra smooth, polished, and punctured. Elytra, exteriorly at least, punctured. Anterior and intermediate femora somewhat incrassate. First segment of each tarsus longer than the other two segments together; third longer than the second.

Long. ♂ 7 mm., ♀ 9 mm.

Hab. Birara (*Willey*); New Guinea (*Walker*).

Genus Dindymus.

Dindymus, Stål, 1861, O. V. A. F., p. 196.

Distributed throughout Oriental, Ethiopian and Australian Regions.

Dindymus famosus, Distant.

Dindymus famosus, Dist., Trans. Ent. Soc. Lond., 1901, p. 589.

Hab. Birara (*Willey*).

DINDYMUS PYROCHROA, Boisduval.

Dysdercus pyrochroa, Boisduval, 1835, Astrolabe Ent. II, p. 642, Pl. XI, fig. 9.

Hab. BIRARA (*Willey*), Aru, Moluccas, New Guinea, Myso, etc.

Genus DYSDERCUS, Serville.

Dysdercus, Serville, 1835, in Boisduval, Astrolabe, II, p. 64.

Laporte fixed the type of the genus *Astemma* in 1833, "Essai," p. 38.

"Le genre *Astemma* a été établi sur la *Salda pallicornis* de Fab."

Astemma, Kirk., olim.

DYSDERCUS SIDÆ, Montrouzier.

Dysdecus (sic !) *sidæ*, Montr. and Sign., 1861, l. c., p. 68.

In the Journal Bombay Nat. Hist. Soc., I lumped together a number of forms under the name "*cingulatus*." Dr. Breddin has since kindly sent me specimens of *cingulatus* and *poecilus*, and has explained the difference in the Wiener. Ent. Zeit.

I now find among Dr. Willey's captures what I believe to be the true *sidæ*. *D. cingulatus* is distinguished by the shining, polished, immaculate head (except the base behind the eyes which is generally very narrowly blackish), while *poecilus* and *sidæ* have dull heads. In both of the latter the base of the head beyond the eyes is blackish, though generally more largely in *sidæ*. While in *poecilus* (as in *cingulatus*), the tylus is red, in *sidæ* it is blackish, the black colour often encroaching well over the juga, etc.; the rostrum is also entirely black (except sometimes the extreme apex of the first segment) in *sidæ*, while in the other two, at least the first segment is red. The red colour in *sidæ* is also darker and browner. These characters seem constant, other colour characters are however unreliable in *cingulatus* and *poecilus*, particularly that of the lævigate anterior transverse band on the pronotum. *Sidæ* is perhaps also more strongly punctured.

Dr. Willey has taken *A. sidæ* at Lifu, the original habitat noted by Montrouzier. I have it also in my collection from New Hebrides, New Caledonia and Loyalty Islands. Stål records it from North and West Australia.

Dysdercus cingulatus, Fabricius.

Cimex cingulatus, Fabr. 1775, Syst. Ent., p. 719.
Dysdercus cingulatus, Kirk., J. Bombay Soc., XIV, p. 301, pl. A., figs. 11 and 12 (except some of the synonymy).

Hab. Birara (*Willey*). Widely distributed over the Australian and Oriental Regions.

Dysdercus poecilus, Herr Schäff.

Pyrrhocoris poecilus, Herr Schäff., 1844, Wanz. Ins., VII, p. 17, fig. 699; Breddin, Wien. Ent. Zeit., XX, p. 84.

Hab. Birara (*Willey*). A very similar distribution to that of *cingulatus*.

Genus Ptochiomera, Say.

Ptochiomera, Say, 1832, Descr. Heteropt. (New Harmony).
Plociomera, Leth. and Sev., l. c., II, p. 194.

Distributed over America; also Japan, etc.

Ptochiomera kydippe, sp. nov.

Belongs to Stål's divisions dd. Covered all over, more thickly on head and pronotum, with silvery hair.

Head, pronotum, scutellum and under-side dull black; a silvery posterolateral spot on anterior lobe of pronotum. Posterior margin of pronotum narrowly fulvescent. Elytra pale yellowish-brown, clouded and punctured with blackish-brown. Connexivum pallid brown. Membrane fumate, irregularly marked with pallid. First and fourth antennal segments, more or less blackish, 3rd and 4th fulvous. Legs brownish, apical half of femora black. Rostrum fulvous, first and fourth segments darker. Stink orifices black. Head and eyes wider than anterior margin of pronotum. Fourth segment of antennæ twice as long as the first, a trifle longer than the second, which is a quarter longer than the third. Pronotum somewhat deeply impressed transversely, anterior area three-fifths longer than the posterior; lateral margins rounded, lateral margins of posterior area widely divergent roundly, base slightly sinuately emarginate.

Long. to apex of elytra 5 mm.

Hab. Lifu (*Willey*).

Genus Pachymerus, Auctt., olim.

Pachymerus, Lep. and Serv., 1895, Encycl., X, p. 322.
Aphanus, Leth. and Sev., l. c., II, p. 215 (*nec* Laporte).

Distributed throughout the Old World.

I have used the preoccupied name "*Pachymerus*" because I do not know what the correct name of the genus is.

PACHYMERUS NEREIS, sp. nov.

(Plate XVII, fig. 7.)

Although the fourth segment of the antennæ is partly pallid, this species seems to be a *Pachymerus*, but I have seen only 3 ♀♀.

Head, first segment of antennæ (except extreme apex), extreme apex of 2nd segment, the third (except extreme base) and apical half of the fourth, disk of anterior lobe of pronotum, two spots (one near apex, one near base) on the explanate lateral margin of pronotum, scutellum (except a proportionately long V-mark at posterior angle), two spots near and at apex of costal area; abdomen above entire ventral surface (except rostrum, trochanter, ♀ ovipositor, ambulacra and pleural lateral margin and connexivum), black or blackish; the exceptions all pale yellowish-brown except lateral margins of pleura which are yellowish-white. Stink orifices black. Ocelli close to the eyes, first segment of rostrum reaching to base of head, 4th to about middle of intermediate coxæ. Second and fourth segments of antennæ sub-equal, each a trifle more than twice as long as the first, and a quarter longer than the third. Disk of posterior half of pronotum, scutellum, elytra, etc., very strongly punctured. Elytra pale yellowish-brown, strongly and somewhat closely punctured with brownish-black. Clavus triseriate punctured, also with some irregular punctures between the two interior rows. Membrane pale yellowish-white marbled with pale yellowish-brown. Lateral margins of pronotum rounded, sufficiently widely explanate, more narrowly posteriorly; base truncate. Femora unarmed, except a spine near apex of anterior pair.

♀. Long. 6 mm.

Hab. LIFU (226a *Willey*).

Genus OXYCARENUS, Fieber.

Oxycarenus, Fieber, 1837, Weitenweber's Beitrage, p. 339.

Distributed throughout the Old World; occurs also in Peru.

OXYCARENUS LIFUANUS, sp. nov.

Is intermediate between Stål's divisions b and bb.

Head, rostrum, antennæ, pronotum, scutellum and clavus, black; orificial callosities white, orifices black; abdomen above black, medianly sanguineous. Corium white, with a large black spot in

the middle and a black spot at apical angle of corium. Membrane whitish hyaline with a large brownish-black spot. Legs black, except posterior tibiæ which are white except at base and apex. Ambulacra and posterior margin of metapleura white. Abdomen beneath sanguineous along some of the sutures covered with stiff whitish hairs. Head, pronotum, etc., strongly punctured. Clavus punctured in three parallel rows, and there is also a row of black punctures dividing the corium from the exocorium. First segment of antennæ scarcely reaching beyond the head, second segment half longer than the first, a trifle longer than the fourth, which is a trifle longer than the third. Rostrum reaching well beyond base of abdomen.

Long. 3¼ mm.

Hab. Lifu (*Willey*).

This may be *Macroplax luctuosis*, Montr., but that species is described as finely *granulated*, with the clavus whitish and the membrane brown. It is also a little larger than *O. lifuanus*.

Genus Astacops, Boisduval.

Astacops, Boisduval, 1835, Voy. Astrolabe, II, p. 637.

Australia and the Malayan Archipelago.

Astacops dorycus, Boisduval.

Astacops dorycus, Boisd., l. c., p. 638, pl. xi, fig. 16.

Hab. Birara (*Willey*); also from New Guinea and Mysol.

Astacops, sp. nov.

Hab. Lifu (*Willey*).

This is most probably a good species, but I have refrained from describing it, as it belongs to a difficult group largely characterized by colour-markings, and there is but a single specimen before me.

Genus Stalagmostethus, Stål.

Stalagmostethus, Stål, 1868, Svensk. Vetens. and Akad. Handl., 7, No. 11, p. 72.

Sub-genus *Spilostethus*, Stål, op. cit. = *Lygaeus*, Auctt. nec Fabr.

S. FAMILIARIS, Fabr., var. HOSPES, Fabr.

Cimex familiaris, Fabricius, 1781, Spec. Ins., II, p. 363.
Var. *Lygaeus hospes*, Fabr., 1794, Ent. Syst., IV, p. 150.
= *L. squalidus*, Montrouzier, 1861, A. S. E. F., 4, 1, p. 66.

Hab. LIFU (*Montrouzier* and *Willey*); Brisbane (my coll.); New Caledonia, Philippines, Malacca, China, India, Africa, Europe.

Genus ONCOPELTUS, Stål.

Oncopeltus, Stål, 1868, Svensk., Vetensk., Akad. Handl., 7, No. 11, p. 75.

ONCOPELTUS DISPAR, Walker, var.

(?) *Lygaeus bicinctus*, Montrouzier, 1861, A. S. E. F., p. 67.
Lygaeus dispar, Walker, 1872, Cat., V, p. 60.
„ „ (Willey, 332 n.); Moluccas, Borneo, etc.

Differs from the type by the pallid (sanguineous?) femora. The description of *L. bicinctus* from New Caledonia agrees with this, but the size (7 mm.) is much too small.

Genus GEOCORIS WILLEYI, sp. nov.

(Plate XVII, fig. 8.)

Allied to *G. flaviceps*.

Head, anterior and lateral margins of pronotum, posterior angle of scutellum, first and apical two-thirds of third segments of antennæ, rostrum, legs, etc., pale yellow-testaceous. Rest of antennæ blackish or blackish-brown. Rest of pronotum, scutellum, elytra, abdomen, etc., bluish-black. Eyes red. Basal two-thirds of membrane fumate, apical third hyaline, colourless. Connexivum flavous, spotted with black. Head straight between antennæ and eyes, shortly triangularly prominent in the middle, unpunctate; with the eyes wider than pronotum. Fourth antennal segment fusiform, a little longer than the third, which is a little longer than the second and twice as long as the first. The pronotum has a single row of punctures near the anterior margin, not nearly reaching to the lateral margin, basal two-thirds of pronotum and the entire scutellum somewhat superficially and irregularly punctured; lateral margins of pronotum smooth, straight and sub-parallel. Clavus

with two rows of parallel punctures, interior half of corium not (or superficially) punctured, exterior half more strongly punctured.

Long. 5·4 mm. to apex of elytra; breadth across eyes 2·5 mm.

Hab. Birara (*Willey*).

Family LYGAEIDÆ, Kirk.

(= Coreidæ, Auctt.)

Genus Leptocoris, Hahn.

Leptocoris, Hahn., 1833, Wanz. Inst., I, p. 200.
Scrinetha, Spinola, 1837, Essai, p. 247.

Widely distributed through the Oriental, Australian, Ethiopian and Nearctic regions.

Leptocoris rufomarginatus, Fabricius.

Lygaeus ruformarginatus, Fabr., 1794, Ent. Syst., IV, p. 152.

Hab. Birara (*Willey*); Philippines (Stål).

Genus Myodocha, Latreille.

Myodocha, Latr., 1807, Gen. Crust. Ins., III.
Leptocorisa, Latr., 1825, Fam. Nat., p. 421.

Almost world-wide in distribution except the Palæarctic region.

Myodocha burmeisteri, Montr.

Leptocorisa burmeisteri, Montrouzier, 1865, Ann. Soc. Linn. Lyon., XI, p. 227.

Hab. Birara (*Willey*). Described from New Caledonia; "Se trouve à Kanala dans les champs, sur les graminées, au milieu des herbes" (*Montrouzier*).

Probably two species contained in Willey's captures, but the species of this genus are not very well characterized.

Genus Riptortus, Stål.

Riptortus, Stål, 1859, O. V. A. F., p. 460.

Distributed over the Oriental, Ethiopian and Australian regions, also Japan.

Riptortus imperialis, sp. n.

Allied to *R. robustus*, Dallas.

Head, beneath, juga, base of vertex, pronotum, scutellum, extreme base of elytra, first, second and apical two-thirds of 3rd segment of antennæ, rostrum, sterna and pleura (except as below), coxæ, trochanters, and posterior femora, a broad median longitudinal black band on abdomen below, spots on the apical segments of connexivum above, etc., black or blackish-brown, the posterior femora beneath very polished. Tylus, base of third antennal segment, abdomen above, and laterally below, a broad almost continuous, very smooth, stripe from apex of head to base of metanotum, reddish. Apical segment of antennæ, anterior and intermediate tibiæ, and all the tarsi, a somewhat indefinite pale ochreous. Posterior tibiæ blackish laterally, reddish above and below. Elytra pale ochreo-fulvous, membrane yellowish-brown hyaline. Pronotal spines, acuminate, prominent; pronotum minutely granulate with black. Rostrum reaching to nearly base, fine at sternum. Posterior femora with three or four larger spines and a number of smaller ones. Fourth antennal longer than the first and second together, second and third subequal.

Long. 17½ mm., lat. 4 mm.

Hab. Birara (*Willey*).

(?) Riptortus atricornis, Stål.

Riptortus atricornis, Stål, 1873, Sv. Vet. Ak Handl., 11, No. 2, p. 94.

A specimen from Lifu (*Willey*) is placed here with some little diffidence. *R. atricornis* was described from Australia and Java.

Genus Cletus, Stål.

Cletus, Stål, Eugenies Resa, Hem., p. 236.
Peniscomus, Spinola, in Signoret, 1861, Ann. Soc. Ent. France, 4, 1, p. 66 [nov. syn.].

Distributed over Oriental, Ethiopian, and Australian regions, also from North America.

Cletus amyoti, Montrouzier.

Gonocerus amyoti, Montr., 1861, l. c., p. 66.
Hab. Lifu (*Montrouzier* and *Willey*).

Genus LEPTOGLOSSUS, Guérin.

Leptoglossus, Guérin, 1838, Voy. Coquille, p. 174.

Widely distributed over the Ethiopian, Oriental and Australian regions (including the Pacific Isles), America, and the Canary Isles.

L. MEMBRANACEUS, Fabricius.

(?) *Cimex australis*, Fabr., 1775, Syst. Ent., p. 708.
Cimex membranaceus, Fabr., 1781, Spec. Ins., II, p. 351.
Anisoscelis (*Lygaeus*) *bidentatus*, Montr., 1855, l. c., p. 101.

Solomons Islands, Guodalcanar (*Willey*, June 11, 1897); also from Woodlark, New Caledonia and San Cristoval, North Australia, Philippines, Africa, India, Ceylon, Canary Isles, etc. Willey's examples are typical *membranaceus*; *L. australis*, which is doubtfully distinct, is from Tahiti. "Vit sur les Cucurbitacées. On le trouve aussi sur certains acacias" (Montrouzier).

Genus MICTIS, Leach.

Mictis, 1814, Leach, Zool. Misc., I, p. 92.
Oriental, Australian, and Ethiopian regions.

MICTIS PROFANUS, Fabricius.

Lygaeus profanus, Fabricius, 1803, Syst. Rhyng., p. 211.
Nematopus profanus, Montr., 1855, l. c., p. 102.

Hab. LIFU (*Willey*); also from Australia, Woodlark, New Caledonia, Viti, Samoa, San Cristoval, etc. "Vit sur les mimosa" (Montrouzier).

Genus PRIOCNEMICORIS, Costa.

Priocnemicoris, Costa, 1863, Rend. Acad. Napol., II, p. 253.
New Guinea and neighbouring islands.

PRIOCNEMICORIS ALBITHORAX, Boisd., var. PATRICIUS, nov.

I have not been able to examine *P. albithorax*, Boisd., 1835 (= *flaviceps*, Guérin, 1838), and am therefore unable to differentiate this form specifically. It differs from the typical form, as figured by Boisduval and Guérin, by the unicolorous pronotum.

Head, rostrum, entire ventral surface (except the exterolateral margins of the pleura), connexival tergites, legs (except posterior

femora, etc.) olivaceo-testaceous. Eyes, ocelli, antennæ, etc., dark reddish-brown; 4th segment of antennæ fulvous. Pronotum, scutellum, exterolateral margins of the pleura, clavus, corium, and abdomen above metallic shining green. Posterior femora (except at the base) and base of posterior tibiæ shining greenish-black. Membrane irridescent dark olivaceous, tinged with purple. There is a pale luteous band on the pleura interior to the lateral metallic margin, and a sublateral pale luteous spot on each abdominal tergite. Rostrum reaching to the middle of the mesosternum, which is channelled so far. Fourth segment of antennæ about one-half longer than the first, which is one-sixth longer than the second, which is one-half longer than the third. Pronotum transversely striolate, anteriorly obsoletely callose, sulcate medio-longitudinally. Clavus and corium strongly and finely punctured. Each abdominal segment posterolaterally minutely spined.

♂. 6th (?) abdominal tergite very slightly rotundately emarginate; posterior femora somewhat inerassate, with one larger, median, and three to five smaller spines, near the apex.

♀. 6th (?) abdominal tergite roundly emarginate; posterior femora much less emarginate, lacking the median larger spine.

Long. 19 mm., lat. $5\frac{1}{3}$–$5\frac{2}{3}$ mm.

Hab. Birara (*Willey*). The typical form is from New Guinea.

Genus Pternistria, Stål.

Pternistria, Stål, 1873, Svensk. Vetensk. Akad. Handl., p. 43.

Australia, New Guinea, Birara, and Aru.

Pternistria, sp.

Specimens from Birara (*Willey*) closely agreeing with the description and figure of *macromera* (*Guérin*), which, however, is unknown to me. The latter has been recorded from New Guinea and Aru.

Family CIMICIDÆ.

Genus Megymenum, Laporte.

Megymenum, Lap., 1833, Essai, p. 52.
Megalymenum, Burmeister, Handb. Ent., II, p. 349 (note), 1835.

Distributed throughout the Australian and Oriental regions up to Japan.

M. AFFINE, Boisduval.

Megymenum affine, Boisd., 1835, Voy. Astrolabe, II, p. 633, Pl. 11, f. 12; Montrouzier, 1855, l. c., p. 101.
M. montrouzieri, Leth. and Sev., 1893, Cat. Hem., I, p. 239.

These two names appear to belong to the same form. Stål says of the Montrouzierian, "a *M. affine*, Boisd., vix differt," though the former is in his division "cc" and the latter in "c." Dr. Willey collected specimens from Birara. It has also been recorded from Moiou (*Montrouzier*) and New Guinea.

Genus AGAPOPHYTA, Laporte.

Agapophyta, Lap., 1833, Essai, p. 63.

The genus contains one species.

AGAPOPHYTA BIPUNCTATA, Boisduval.

Agapophyta bipunctata, Guérin, 1838, Voy. Coquille, p. 168. [Pl. 11, f. 5 (1831), not f. 15, as say Leth. and Sev.]

Hab. BIRARA (*Willey*); also from Australia, Tasmania, New Guinea, Woodlark Island, Havre Carteret, Buru and Sarawatte Islands, Moluccas, etc.

"Vit en troupe sur une espèce d'acacia à Woodlark" (Montrouzier).

Genus CATACANTHUS, Spinola.

Catacanthus, Spinola, 1837, Essai Hémipt., p. 325.

Distributed from India and Ceylon to Toga and from Australia to Japan.

C. PUNCTUM, Fabricius.

Cimex nigripes, Subzev., 1776, Gesch. Ins., p. 96, Pl. 10, fig. 9 (nec Fabr.).
C. punctum, Fabricius, 1787, Mant. Ins., II, p. 291.
C. carrensi, Le Guillou, 1841, Rev. Zool., p. 262.
Pentatoma tricolor, Montrouzier, 1855, l. c., p. 96.
Catacanthus nigripes, Leth. and Sev., 1893, Cat. I, p. 163.

Hab. BIRARA (*Willey*; typical *punctum*); Woodlark, Art, Australia, Philippines, Java, etc.

Genus AGONOSCELIS, Spinola.

Agonoscelis, Spinola, 1837, Essai, p. 327.

Widely distributed over Ethiopian, Oriental and Australian Regions.

AGONOSCELIS RUTILUS, Fabricius.

Cimex rutilus, Fabricius, 1775, Syst. Ent., p. 714.

Hab. BIRARA (*Willey*); also recorded from Australia, Moluccas, Java, Celebes, Batchian, Banda, etc.

Genus PLAUTIA, Stål.

Plautia, Stål, 1864, Hem. Afric., I, p. 191.

Distributed similarly to the foregoing genus.

PLAUTIA BRUNNIPENNIS, Montrouzier.

Pentatoma brunnipennis, Montr., 1861, l. c., p. 63.

Hab. BIRARA (*Willey*); LIFU (*Stål*); NEW CALEDONIA (*Montrouzier*).

A very variable species. In one specimen the posterior half of the pronotum is black and there is a large black spot towards the posterior angle of the scutellum. The corium may be immaculate or heavily spotted with black. Venter usually immaculate, but in the example first mentioned, there are three black spots on each segment. Differs from *P. fimbriatus*, Fabr., by the absence of the black thread-line on the lateral margins of the pronotum; scarcely separable from *P. affinis*, Dallas, from Australia, except that the pronotum is more coarsely punctured in the present species.

Genus ANTESTIA, Stål.

Antestia, Stål, 1855, O. V. A. F., p. 54.

Similar distribution to the foregoing.

ANTESTIA CHAMBERETI, Le Guillon.

Strachia chambereti, Le Guillon, 1841, Rev. Zool., p. 262.

Hab. BIRARA (*Willey*); also from New Guinea, Woodlark, and Waigiu.

Genus Stenozygum, Fieber.

Stenozygum, Fieber, 1861, Europ. Hem., p. 345.

Oriental, Ethiopian and Australian regions, also South-eastern Palæarctic.

1. Stenozygum erythraspis, Boisduval.

Pentatoma erythraspis, Boisd., 1835, Voy. Astrolabe, pt. 2, p. 629, Pl. 11, fig. 8.

Hab. Birara (*Willey*); also recorded from Moluccas, Ceram, Batchian, Halmahera, Carteret, Ké and New Guinea.

Genus Vitellus, Stål.

Vitellus, Stål, 1865, Ann. Soc. Ent. France, 4, 5, p. 170.

Distributed over Australia and the Malayan and Pacific Isles.

Vitellus pungens, Montrouzier.

Rhynocoris pungens, Montr., 1861, l. c., p. 66.
Vitellus pungens, Stål, 1865, l. c., p. 172.

Hab. Birara (*Willey*); one ex. measuring 16 mm. long; Woodlark (*Montrouzier*).

Genus Zangis, Stål.

Zangis, Stål, 1867, O. V. A. F., p. 514.

Distributed over Australian, Ethiopian and Oriental Regions.

Zangis montrouzieri, Leth. and Sev.

Rhaphygaster sulcatum, Montr., 1861, l. c., p. 65.
Zangis montrouzieri, Leth. and Sev., 1893, l. c., p. 170.

Doubtfully distinct from *Z. sulcatum* (Montr.), Stål.

Hab. Birara (*Willey*); New Caledonia (*Stål*); Lifu (*Montrouzier*).

Genus Cuspicona, Dallas.

Cuspicona, Dallas, 1851, List., p. 296.

Oriental and Australian regions.

Cuspicona laminata, Stål.

Pentatoma viride, (p.) Montrouzier, 1855, l. c., p. 98.
Cuspicona viride, (p.) Montrouzier and Signoret, 1861, l. c., p. 65.
C. laminata, Stål, 1876, Svensk. Akad. Handl., 11, No. 2, p. 102.

Hab. Lifu (*Willey* and *Montrouzier*); Woodlark (*Montrouzier*), and New Caledonia (*Stål*).

Genus Eurinome, Stål.

Eurinome, Stål, 1867, O. V. A. F., p. 516.

New Caledonia, Lifu and the Philippines.

Eurinome basiventris, Signoret.

Pentatoma inconspicua, Montrouzier, 1858, l. c., p. 249 (nec Dallas).
P. basiventris, Signoret, 1861, Ann. Soc. Ent. France, p. 63.

Hab. Lifu (*Willey*); Balade "commune dans les herbes, à terre sous les végétaux en décomposition" (*Montrouzier*).

Genus Coctoteris, Stål.

Coctoteris, Stål, 1858, O. V. A. F., p. 435.
Coccoteris, Leth. and Sev., 1893, l. c., I, p. 100.

New Guinea, Birara and Woodlark.

Coctoteris exiguus, Distant.

Coctoteris exiguus, Distant, Trans. Ent. Soc. Lond.

A very variable species, the ground-colour ranging from pale greenish-cinereous to a fine rosy hue.

Hab. Birara (*Willey*); New Guinea (*Distant*).

Genus Eysarcoris, Hahn.

Eysarcoris, Hahn, 1834.

Universally distributed.

Eysarcoris megaspiloides, Tryon.

Hab. Birara (*Willey*); originally described from New Guinea.

Genus Adrisa, Am. Serv.

Adrisa, Amyot and Serville, 1843, Hémiptères, p. 89.
Geobia, Montrouzier, 1858, Ann. Soc. Linn. Lyon., p. 245.

"Vit toujours à terre sous les plantes, les végétaux en décomposition, et répand une odeur tres fétide" (M.).

Adrisa willeyi, sp. nov.

Differs from the other Australo-Polynesian species by its more elongate and parallel-sided form; from *A. similis*, Signoret by the prosternum being only obsoletely punctured, different ostiolary structure, also the tylus not at all surpassed by the juga and the elytra reaching far beyond apex of abdomen; from *A. numeensis*, Montrouzier by the longer membrane, more feebly punctured pronotum and different ostiolary structure. Black (somewhat dull), lateral margin of pronotum very narrowly fulvous, posterolateral angles yellowish. Elytra strongly punctured with black, clavus internally and the nervures of the corium, castaneous; exterior one-third of corium and apical margin of the same narrowly, yellowish. Membrane yellowish hyaline, mottled with pale brown. Basal two segments of antennæ, rostrum, and anterior tibiæ, fulvous; third segment of rostrum fumate, fourth segment, intermediate and posterior tibiæ and all the tarsi, yellowish; coxæ, femora, entire ventral surface and tibial spines, black. Head smooth, somewhat irregularly and obsoletely striolate. Pronotum somewhat feebly punctured, except on the smooth anteromedian area. Scutellum similarly punctured, more strongly and regularly at the sides. Elytra strongly and closely punctured, more strongly so at the base; apical margin of corium sinuate. Membrane reaching well beyond apex of abdomen. Second segment of antennæ $3\frac{1}{3}$ times as long as the first, and one-third longer than the third which is equal to the fourth. Second and third segments of rostrum subequal, each two-fifths longer than fourth. Anterior femora incrassate.

Long. $11\frac{1}{2}$–$12\frac{1}{2}$ mm. (to apex of elytra), lat. 6–$6\frac{7}{8}$ mm. across widest part of elytra.

Hab. Lifu (*Willey*, 226a, 212b, 319).

Geotomus, Mulsant and Rey.

Geotomus, M. and R. 1866, Punaises Pentat., p. 34.
Signoret, 1883, Ann. Soc. Ent. France, p. 33.

Almost world-wide.

GEOTOMUS PYGMÆUS, Dallas.

Cydnus pygmæus, Dallas, 1851; List, p. 129.
Geotomus pygmæus, Signoret, 1883, l. c., p. 51, Pl. 3, fig. 160.

Hab. LIFU (*Willey*); described under eleven names; from India to New Caledonia and the Hawaiian Archipelago.

GEOTOMUS, sp. ?

Probably a new sp. but I have inadequate material before me.

Genus CHRYSOCORIS.

Chrysocoris, Hahn, 1834, Wanz, Inst., II, p. 38.

Distributed over the Oriental and Australian regions.

CHRYSOCORIS SEXMACULATA, Leach.

Scutellera sexmaculata, Leach, 1815, Zool. Misc., II, p. 36, Pl. XIV.
S. arrogans, Montr., 1858, l. c., 2, V, p. 258.
S. grandis, Montr., Ann. Soc. Ent. France (1861), p. 60 (nec Thunberg).
Chrysocoris (*Eucorysus*) *sexmaculatus*, Stål, Svensk. Akad. Handl., p. 19.

Hab. LIFU (290a *Willey*); also recorded from New Caledonia, Art, etc.

Genus PHILIA, Schiödte.

Philia, Schiödte, 1842, Kroyer's Nat. Tidsskr., IV, p. 279.

Distributed over Oriental Islands and Australian region.

PHILIA FEMORATA, Walker, var. AUREOCINCTA, Walker.

Callidea aureocincta, Walker, 1867, Cat. Hem. Het., I, p. 41.

Hab. BIRARA (Septr., *Willey*); the variety is recorded from New Guinea; the species is also recorded from Moluccas and Ceram. The placing of *aureocincta* as a var. of *femorata* is on Distant's authority.

Philia leucocyanea, Montrouzier.

Scutellera leucocyanea, Montr., 1855, l. c., p. 95.
Philia leucocyanea, Stål, 1868, Svensk. Vetensk. Akad. Handl., 7, No. 11, p. 10.

Differs from Montrouzier's description by the pronotum being of the general ground-colour, with the anterior and posterior margins metallic (green or blue). Femora usually crimson. Posterior angle of scutellum always blackish.

Hab. Lifu and Birara (*Willey*); also recorded from Murua, Solomons and Duke of York's Island. One example from Lifu has the scutellum largely clouded with blackish, and several specimens from Birara have a nebulous blackish median line down the scutellum.

Var. ebenina, J. Martin.

Philia ebenina, J. Martin, 1898, Bull. Soc. Ent. France, p. 226.
P. leucocyanea, var. *ebenina*, Distant.

Hab. Birara (Paris Mus. and *Willey*).

One specimen has four yellowish-brown spots on the scutellum; the anterior lateral margins of the pronotum are also yellowish-brown. It would perhaps be more correct to state the ground-colour as yellowish-brown, with blackish-brown markings.

Genus Tectocoris, Hahn.
Tectocoris, Hahn, 1834, Wanz. Inst., II, p. 33.

This genus contains one species only.

Tectocoris lineola, Fabricius.

Cimex lineola, Fabr., 1781, Spec. Inst., II, p. 340.
Tectocoris lineola, Leth. and Sev., 1893, Cat. Hem., I, p. 19.
Scutellera banksii, Montrouzier, 1855, Ann. Soc. Afric. Lyon (2), VII, p. 92, and 1858, Ann. Soc. Linn. Lyon (2), V, p. 243.
Tectocoris banksii, Montrouzier, 1861, Ann. Soc. Ent. France, p. 60.

The synonymy of this variable species is given by Lethierry and Severin, the variations are described at length by Montrouzier, Stål (1873, Svensk. Vet. Akand Handl., 11, No. 2, p. 11), and Vollenhoven (1863, Essai Faune Ent. Archip. Indo-néerl., I, p. 7). Dr. Willey has collected two

examples, (*α*) allied to var. *tongæ*, Boisduval; bluish, a small median spot on the pronotum anteriorly, a spot near each anterolateral angle of pronotum, anterior margin prosternum, base of abdomen and incisures of abdominal sternites (also apparently part of beneath abdominal tergites) sanguineous. (*β*) very near typical *banksii*, Montrouzier (which is not var. *banksii*, Donovan, but is near *diophthalmus*, Thunberg). Pale luteous above, testaceous below; lateral margins of tylus, vertex behind the eyes, two anterior submedian wedge-shaped spots on pronotum—brownish-black with a suspicion of metallic green. Connexivum (except extero-lateral margin narrowly), antennæ, a sublateral spot on each pleuron, apex of femora, the tibiæ and tarsi metallic green.

Hab. Lifu (No. 319, *Willey*); extended over the whole of Malaysia from Java eastward, Australia, Polynesia, etc. (*Woodlark*); Isle of Pines, New Caledonia, Art, Isles to the north of New Caledonia, etc., on *Hibiscus tillaceus* (*Montrouzier*); "Elle vit à Woodlark en troupes, dépose un très-grand nombre d'œufs en forme de barillet, d'abord blancs, et prenant une teinte de plus en plus rougêatre à mesure qu'ils approchent du temps de l'éclosion" (Montrouzier).

Genus Cantao, Am. Serv.

Cantao, Amyot and Serville, 1843, Hist. Nat. Hem., p. 29.

Distributed over the Oriental region up to Formosa and to Australia and Polynesia.

1. Cantao variabilis, Montrouzier.

Scutellera variabilis, Montr., 1855, l. c., (2) VII, p. 93 [not (2) I, as in Leth. and Sev. Cat.]

Cantao variabilis, Stål, 1873, Svensk. Akad. Handl., p. 10, 11, No. 2.

Hab. Birara (*Willey*); Moiou (*Montrouzier*).

This is a very variable species.

Montrouzier in speaking of the *Scutellerinæ* of Oceania (I, p. 91), says: "Les mœurs de ces Scutellères sont interessantes. Plusieurs d'elles déposent leurs œufs sous le revers des feuilles pour les mettre à l'abas de la pluie, les coudrent de leur corps, et quand ils sont éclos, conduisent leurs petits et les protègent jusqu'à ce qu'ils

aient acquis leurs ailes. On voit leur nombreuse famille les suivre le long des arbres et se presser vers elles au moindre danger. Plusieurs aussi sont parées des plus vives couleurs, et je n'ai encore rencontré chez aucune l'odeur fétide que laissent échapper les *Pentatomes*. . . . . Quant aux lieux où on les trouve, ils varient selon l'espèce. Il est des *Scutellères* comme ma *S. metallica* (=*Philia senator*, Fabr.,) var., qui vivent sur les buissons exposés au soleil. D'autres, comme ma *S. splendida* (= *Calliphara billiardiens*, Fabr.), choisissent les lieux ombragés où croît une espèce de myrtacée. La *S. banksii* (= *Tectocoris lincola*, Auctt.) aime beaucoup les endroits où croîssent les ketmies à feuilles de tilleul."

Genus Coptosoma, Laporte.

Coptosoma, Lap., 1832–3, Essai, p. 73.

Distributed throughout the Old World.

Coptosoma sphærula, Germar.

Coptosoma sphærula, Germ., 1839, Zeitschr., Ent. I, p. 25.

Hab. Birara (*Willey*).

Described under thirteen names, from India, Siam, Java, Ceylon, China, Celebes, Sula, Borneo, Papua, etc.

Genus Brachyplatys, Boisduval.

Brachyplatys, Boisd., 1835, Voy. Astrolade, Ent. II, p. 627.
Platycephala, Lap., 1832–3, Essai, p. 74.
Plataspis, Hope Cat., 1837, I, p. 16.

Similar distribution to *Coptosoma* except that it does not enter the Palæarctic region.

Brachyplatys pusillus, Tryon.

Brachyplatys pusillus, Tryon, 1892, Ann. Mus., Queensland, p. 13.

Hab. Birara (*Willey*); New Guinea (*Tryon*).

Kindly identified by Mr. Distant.

Explanation of Plate XVII.

Fig. 1. *Ucana harmonia.*
2. „ *polymnia.*
3. *Clovia birarensis.*
4. *Aufidus hyperion.*
5. *Thalattoscopus dryas.*
6. *Peggioga formosa.*
7. *Pachymerus nereis.*
8. *Geocoris willeyi.*

October 4th, 1905.

XX. *The Blind Coleoptera of Australia and Tasmania.*

By Arthur M. Lea, F.E.S., Government Entomologist, Tasmania.

[Read October 5th, 1905.]

Blind Coleoptera in Australia are principally to be taken under stones, or at the roots of beach-growing plants. In other parts of the world many species have been taken in caves, but so far no one has so taken them in Australia, although they have been specially searched for on several occasions. I have myself searched for them without success in caves in Western Australia, New South Wales, and Tasmania. The total number of blind species (including one now first described) recorded from Australia and Tasmania is but eight (four from Tasmania, two from New South Wales, and two from Western Australia, a number probably far short of the total to be obtained by diligent searching. All the species are of small size with, as elsewhere, the body apterons and elytra soldered together.

Following are given notes on all the known species.

CARABIDÆ.*

Illaphanus stephensi, Macl.

In company with Messrs. H. J. Carter and E. Ferguson at Otford, my brother (Mr. A. H. T. Lea) at Watson's Bay near Sydney and Mr. R. Helms, also at Watson's Bay, I have recently (April 1905) taken specimens of this interesting little species. The original locality was Wollongong, but the late Rev. R. L. King also took the species at Parramatta and Mr. H. W. Cox has taken it at the Lane Cove River. It is thus fairly widely distributed, and that

* *Steganomma porcatum*, Macl., was recorded (P. L. S., N.S.W., 1904, p. 60) as blind, but it really has eyes, although these are small and very difficult to find.

it has not been taken more frequently must be put down to its small size and to its habit of clinging to the under surface of deeply buried stones, which in the ordinary way would seldom be turned over in the search for insects. We found it necessary in searching for it to kneel on the ground and closely examine every inch of the surface of the stones turned over, as the insects, although fairly active when in motion, are not always ready to move, and their minute size and dingy colour render them very inconspicuous. The stones favoured by them are nearly always of fairly large size and are always deeply buried in damp (but not wet) places, and it generally takes two men to turn them over.

The upper surface is clothed in sparse short pale pubescence, but this is almost invisible, except from the sides. The original figure is not a very good one.

Some specimens taken at Watson's Bay appear to represent a variety, as they differ from normal specimens (in the company of which they were taken) in being decidedly larger (much smaller than *macleayi*, however), darker in colour, more parallel-sided, the cephalic impressions less marked and the median line of the prothorax more distinct.

Illaphanus macleayi, n. sp.

Pale testaceous, appendages still paler. Clothed with short and very sparse pubescence ; a long seta on each side of the prothorax towards both apex and at base ; head with two setæ on each side behind antennæ.

Head slightly longer than wide, obtusely longitudinally impressed on each side of middle, sides from antennæ to base gently curved. Antennæ extending to hind coxæ, two basal joints stout, first almost as long as second and third combined, second distinctly longer and stouter than third, third to tenth more or less head-like, eleventh slightly wider and about twice the length of tenth. *Prothorax* distinctly wider than head, not much wider than long, apex incurved to its middle, sides rounded in front and slightly incurved to base, base strongly bisinuate ; median line narrow and distinct ; impunctate. *Elytra* distinctly wider than prothorax, more than twice as long as wide, not quite covering tip of abdomen, sides gently diminishing in width to base and rather more noticeably to apex, margins finely channelled throughout, densely but obscurely punctate. *Mesosternal epimera* wide. *Legs* strong ; front tibiæ strongly dilated and deeply

notched towards apex, the others slightly dilated and not notched ; tarsi rather short. Length 1½ to 2 mm.

Hab. N. S. Wales, Otford. (*H. J. Carter* and *A. M. Lea.*)

The male differs from the female * in being smaller, with stouter legs, longer antennæ, and wider front tarsi. The two specimens described were taken under small but deeply buried stones in a small gully near the Otford railway station. The pubescence can only be seen distinctly from the sides; the setæ are also by no means distinct.

Readily distinguished from *I. stephensi* by its much greater size, and by the absence of the strong elytral striæ so noticeable in that species. Other differences are that in *stephensi* the prothorax at its widest is very little wider than the head or narrower than the elytra, and that its apex is considerably wider than its base and its sides with less sinuous outlines.

COLYDIIDÆ.

Anommatus 12-striatus, Müll.

This minute British species I have taken at the roots of grass in Hobart. Specimens must be common, although seldom seen, as I obtained nineteen living specimens and fragments of many others by the use of sieves. The plan adopted was to break up the earth for about three inches from the surface, this was then thrown into water and stirred about; every thing that floated was picked out, dried, and afterwards put through sieves, the rubbish that came through the finest sieves being gone over on white paper in the ordinary way. The specimens would often remain for minutes together without moving, and even when they did move would walk at a very slow rate.

SCARABAEIDÆ.

Phycochus graniceps, Broun.

In Hobart, obtained at the roots of plants (usually the bracken fern) growing close to the sea-beach. I have seen

* The type female has been returned to Mr. Carter.

very few living specimens, but many dead ones. Mr. J. J. Walker (who first took it at Hobart, in June 1901) informs me that in New Zealand he obtained many specimens under old logs partially buried in the sand of sea-beaches.

Phycochus sulcipennis, Lea.

Obtained at Hobart in company with the preceding species, than which it is rather more numerous.

CURCULIONIDÆ.

Halorhynchus geniculatus, Lea.

Numerous specimens of this species were obtained at the roots of a small species of salt-bush (*Atriplex*) growing just above high-water mark on the outer beach at Geraldton (Champion Bay). They remained quite motionless for a considerable time after being exposed.

Halorhynchus cœcus, Woll.

I repeatedly searched for this species at Cottesloe and other beaches close to Fremantle (the original locality) but never found more than two specimens; these were taken at the roots of a species of spinifex grass.

Tasmanica myrmecophila, Lea.

The type specimen of this species was obtained in Hobart under a stone in the nest of an ant. No other specimen has been recorded, although the species has been repeatedly searched for; but there is a minute specimen in the Australian Museum (from the late Rev. R. L. King's collection, without locality label, but probably taken about Parramatta) which may belong to the species. The specimen in question is old and dirty, but I could see no eyes in its head, and from memory it struck me as probably being *T. myrmecophila*.

XXI. *On a Collection of Butterflies made in Marocco, in* 1900-01-02. By E. G. B. Meade-Waldo. (Communicated by H. J. Elwes, F.R.S., etc.)

[Read October 18th, 1905.]

Plates XVIII, XIX.

Though the butterflies of the neighbourhood of Tangier and of some other points on the coast of Morocco have been collected by the late Mr. J. H. Leech and Mr. J. J. Walker, yet no really important collection has been made in this little-explored country. The following collection was made during an eighteen months' residence in Marocco. Collecting at and in the neighbourhood of Tangier, viz. within 20 miles, and on a long excursion which started from Tangier on May 8th, 1901, and lasted until August 21st. We went by way of Bushārin to Rabat, thence by Fedulla, and striking inland over the central plains to Beni Meskin, crossed the Ouad Moorbey, Oom-er-rebia of the maps, and went eastward, spending some time at a tiny tent village on the desert called Oolad Lasara. Throughout the central plains the heat was great, often reaching 116° in the shade, with hot nights, and owing to this, and also to a previous visitation of locusts which had consumed almost all vegetation, nothing much could be done except on the banks of the river. From here we went slowly south to Marrákesh (Marocco City), and then into the Great Atlas, which we entered at Agūrgūr; from here we went, first southward until we struck the valley of the Ouad Nyfys, which we followed until we got to the watershed above Tsigidir-el-bor, then retracing a short way struck westward until we reached the "Amsmiz." Here we encamped for some time at a Berber village called Sould Jedid, which was delightfully situated about 6,000 feet up, and with most pleasant inhabitants. The mountains here only rise to about 9,000 feet and are to a considerable extent covered with damp forest on their northern slopes; this forest consists largely of Arar (*Callitris quadrivalvis*), Prickly Oak, Holly, *Laurustinus*, *Arbutus*, etc. We did not come to Pine (*Pinus halepensis*) until we reached the Imentalla valley a day's journey further on. After spending some days collecting in this neighbourhood, we started light, with only a little

food, our mules and one pack mule, up a lateral valley so as to get nearer to a great peak, which the natives called Tizi Gourzá, but which according to Thompson's map must be Jebel Ogdimt. We bivouacked at the last hamlet at the top of this valley, a place called Imi Ouern. This place, which appeared to be "the end of all things," would have been splendid for a prolonged stay, but no food could be procured, shooting was not safe, and we were a very small party. It was most beautifully situated and appeared to be highly productive in butterflies and moths. We ascended the mountain and made a most interesting collection of butterflies; from here we returned to Imentalla, and by slow stages worked our way northward and westward by way of Anzoot and Tafegar to Mogador, which we reached on August 21st. In the early spring of 1902 I paid a visit to the forest of Marmora, the only tract of primæval forest in the north of Marocco. It lies between the Seboo and Bou-reg-reg, east of Rabat. It is entirely unexplored, and would probably be very productive, it is however populated only by bandits, and anything like shooting or collecting is almost impossible. However, I managed to collect a considerable number of moths, and a few butterflies. The primary object of these excursions were ornithological, but I collected both butterflies and moths all the time, and paid special attention to the high mountain species. An analysis of this list will show how very few species there are in these remote regions that are not also to be found in the Mediterranean region, and that these mountains have developed comparatively few Alpine species.

I was accompanied on both these excursions by M. Henri Vaucher of Tangier, as taxidermist and interpreter. M. H. Vaucher is a Swiss gentleman who has lived most of his life in Marocco, is an enthusiastic naturalist himself, and such success as attended these expeditions is almost entirely due to his great tact and intimate knowledge of how to treat the extremely difficult inhabitants of this fascinating country. It is to Mr. H. J. Elwes that I must tender my thanks for the trouble he has taken in going over the collection of butterflies and in assisting me with naming those that are new, and to Sir George Hampson for going through and naming the moths.*

* The remarks by Mr. Elwes are in brackets signed "H. J. E."

1. *Papilio podalirius*, L. and var. *feisthameliï*, Dup. March 12th, 1901, bred, fed on Cherry.

Tangier, March 22nd, 1901. Amsmiz, June 27th, 1901. Imentalla, 5,500 feet, July 9th, 1901.

Is universally distributed, and on the wing the whole summer, very fond of the tops of low mountains of about 5,000 ft. elevation, where it may be seen in numbers on the leeward side during the heat of the day. The larva feeds on Cherry. Both *P. podalirius* and var. *feisthamelii* occur at Tangier in March.

2. *P. machaon*, L.

Tangier, January 19th, 1901. Just emerged. Amsmiz, June 27th, 1901. Tangier, August 29th, 1901. Forest of Marmora, March 28th, 1902.

On the wing at intervals from January until September.

3. *Thais rumina*, L.

Tangier, February 27th, 1901. Tangier, April 3rd, 1901. Tangier, March 9th, 1901. Tangier, March 19th, 1901 (var. *canteneri*, Hey.).

This variety is not very uncommon late in the season, and only occurs as far as I could see in the ♀. The perfect insect is only on the wing from the end of February until the beginning of April. Feeds on *Aristolochia bœtica*.

4. *Picris brassicæ*, L.

Only taken at Tangier in all months from December to August. I did not see it on the wing in the summer anywhere in the central plains.

Tangier, January 17th, 1900, December 25th, 1900; August 26th, 1901; January 17th, 1902.

["The specimens are large but do not approach var. *cheiranthi*, Hübn., and the seasonal differences are slight.

"The form known as var. *wollastoni*, Butler, from Madeira closely resembles some of these."—*H. J. E.*]

5. *Picris rapæ*, L.

On the wing all the year round in the north. I did not see it in the Great Atlas, but throughout the plains wherever there was moisture diminutive forms were ubiquitous in summer.

Tangier, March 13th, 1901. Klatsa, May 13th, 1901. Saffi, August 27th, 1901.

6. *Pieris daplidice*, L.

Universal in summer, taken only in the Atlas from 6,500 to 9,000 ft. in July in the central plains. I saw many diminutive individuals.

Wad Moorbey, June 16th, 1901. Sould Jedid, July 3rd, 1901. Tsauritz Entsagauz, 9,000 feet, July 13th, 1901.

7. *Euchloe belemia*, Esp.

Extremely abundant and universal, and on the wing almost the whole year. I did not see many in the height of the summer.

Tangier, December 8th, 1900; March 13th, 1902.

8. *Euchloë cupheno*, Esp., and var. ♀ *androgyne*, Leech.

(Plate XIX, fig. 7, var. ♀ *androgyne*.)

Extremely abundant and universal during March and April in the north of Marocco. I saw very few in the forest of Marmora, and the only one, a ♀, which I caught, is an *androgyne*.

Tangier, March 9th, 1901. Tangier, April 15th, 1901. Hawara, May 4th, 1901. Forest of Marmora, March 28th, 1902, ♀, var. *androgyne*, Leech.

9. *Teracolus daira*, Klug., var. *nouna*, Luc.

(Plate XIX, fig. 8, ♂, 9, ♀.)

I only saw this species at Agūrgūr, where it was abundant in a damp wood at an elevation of about 3,500 ft. I saw one torn specimen near Tsigidir-el-Bor about 30 miles south.

Agūrgūr, June 24th, 1901. Tsigidir-el-Bor, June 25th, 1901.

10. *Colias edusa*, L.

On the wing practically all the year. Extremely abundant in summer, var. *helice*, Hübn., not uncommon. I took one specimen with one forewing, *helice*, the other normal. Very variable.

Tangier, December and January. Interior, May and June.

11. *Gonepteryx rhamni*, L.

Is common in the north of Marocco, a very large form. I did not see any in the south; it is on the wing at intervals during the winter and spring, and again in the

late summer; both it and the next species feed on *Rhamnus alaternus*.

Tangier, March 22nd, 1901. Tangier, December 23rd, 1902.

12. *Gonepteryx cleopatra*, L.

Is commoner, and more widely distributed than the last. I saw it throughout the country.

Tangier, January 1st, 1901. Fedulla, May 28th, 1901. Moorbey, June 5th, 1901. Sould Jedid, 6,500 feet, July 1901.

13. *Charaxes jasius*, L.

Locally common, somewhat of a mountain species, but the males travel long distances; frequents fig-trees when the fruit is ripe and becomes stupefied. A few on the wing in April and May, and common in August and September. Some specimens are very large.

Tangier, August 16th, 1901, September 15th, 1901.

14. *Pyrameis atalanta*, L.

On the wing nearly all the year.

Tangier, Feb. 16th, 1901. Tangier, March. Amsmiz, June 19th, 1901. Imentalla, 5,500 feet, July 8th, 1901.

15. *Pyrameis cardui*, L.

On the wing all the year, late autumn brood small and dark.

16. *Vanessa c. album*, L.

I saw two or three specimens high up on Tizi Gourzá, and took one somewhat worn, large pale specimen on July 11th, at about 12,000 feet.

["I am not aware that this has been taken in North Africa before."—*H. J. E.*]

17. *Melitæa didyma*, O.

I did not see this species until I got to Rabat, after that I saw it at intervals throughout the country, both in the plains and at a considerable height in the mountains.

Rabat, May 16th. Agūrgūr, July 6th, 1901. Tsauritz Entsagauz, 9,000 feet, July 4th.

["This form agrees with the specimens from Kabylia and the oasis of Biskra known as var. *deserticola*, Obth.; it does not vary appreciably between the plains and high mountains."—*H. J. E.*]

18. *Argynnis lathonia*, L.

I only saw this in the Atlas, where it was not uncommon.
Sould Jedid, July 1901. Tsauritz Entsagauz, July 1901.

19. *Argynnis pandora*, Schiff.

I only saw two worn specimens in the north of Marocco; it is certainly scarce on the low ground; it was abundant in the Great Atlas, and I saw it at an elevation of over 12,000 feet.
Sould Jedid, July 2nd, 1901. Tizi Gourzá, July 11th, 1901.

20. *Melanargia ines*, Hoffm.

I only saw it at one spot on the leeward side of a stony peak, everywhere else the following was abundant.
Tsauritz Entsagauz, July 6th, 1901.

21. *Melanargia lucasi*, Ramb.

Abundant in the Great Atlas, most frequent in the woods.
Tsauritz Entsagauz, July 4th. Imentalla, July 8th, 1901. Sould Jedid, July 2nd.
A very large and pale form was taken in the central plains in June, and also on the high table-land above Agũrgũr, on June 23rd.

22. *Satyrus briseis*, L.

Locally common high up in the Atlas, but not on the highest tops.
Tizi Gourzá, July 11th, 1901, about 9,000 feet.
["Very variable, and large, under-side of hind-wing very strongly marked."—*H. J. E.*]

23. *Satyrus semele*, L.

I only saw a few in the mountain woods.
Imentalla, July 6th, 1901. Tsauritz Entsagauz, July 4th, 1901.

24. *Satyrus mniszechi*, H. S., var. *maroccana*, Meade-Waldo, n. var.

Plate XIX, fig. 3, ♂, 4, ♀.)

With the exception of one individual I only saw this insect on one stony slope at the top of one of the peaks of Tsauritz Entsagauz. There it is abundant.

Tsauritz Entsagauz, July 6th and 7th, 1901, 9,000 ft.

["The occurrence of a form of this purely eastern group so far from any region where any have been previously found is very curious, but it may be constantly distinguished from the Syrian or Persian forms, by the different form of the sexual band on the fore-wing of the ♂, which instead of forming a broad velvety patch of raised scales extending almost to the hind margin of the fore-wing, as in the Syrian form of the species, is a comparatively narrow band. Another point of distinction is in the cilia of the hind-wings which are very much less scolloped than in *mniszechi* or in the various forms of *S. pelopea*. On the under-side, though the median bands of the fore-wing are better marked than usual, yet the position of all markings are identical in Syrian specimens, and I do not therefore think it justifiable to treat this as a distinct species."—*H. J. E.*]

25. *Satyrus abd-el-kader*, Pier.

I saw this fine insect commonly on Tizi Gourzá, but on such bad ground I was only able to take two worn females.

Tizi Gourzá, July 11th, 1901.

26. *Satyrus actæa*, Esp.

Was common and only just on the wing in the Great Atlas, at from 8,000 to 10,000 ft. mostly on open ground.

Tsauritz Entsagauz, July 6th, 1901, also on Tizi Gourzá.

27. *Pararge mæra*, L.

I only saw a few specimens on Tizi Gourzá, and nowhere else in Marocco. I am not aware that this species has been taken previously in North Africa.

Tizi Gourzá, at about 10,000 ft., July 11th, 1901.

28. *Pararge megæra*, L.

Not by any means abundant, but out at intervals throughout the year.

Tangier, December 3rd, 1900. Tsauritz Entsagauz July 4th, 9,000 ft.

29. *Epinephile jurtina*, L., var. *fortunata*, Alph.

Very generally distributed all through the summer.
Klatsa, May 14th, 1901. Ras Doura, May 19th, 1901. Tsauritz Entsagauz, July 7th.

30. *Epinephile lycaon*, Kühn, var. *mauritanicus*, Ober., also var. *lupinus*, Costa.

Common in the Atlas woods. Not seen anywhere else.
Tsauritz Entsagauz, July 6th, 1901. Imentalla, July 9th, 6,500 ft.

31. *Epinephile ida*, Esp.

Common all the summer and universally distributed.
Rabat, May 25th, 1901. Tsauritz Entsagauz, July 4th. Tangier, Sept. 1901.

32. *Epinephile pasiphaë*, Esp.

Very common but local. I did not see it in the south.
El Mediar, May 11th, 1901. Klatsa, May 13th, 1901.

33. *Cœnonympha arcanioides*, Pierr.

Locally common in the north of Morocco. I did not see it in the south.
Hawara, April 1901. El Mediar, May 12th, 1901.

34. *Cœnonympha fettigi*, Obth.

I only saw this insect at one spot above Imentalla, where however it was abundant.
Imentalla, 5,500 ft, July 8th and 9th, 1901.

35. *Cœnonympha pamphilus*, L.

I took typical *C. pamphilus*, in the plains of the north of Morocco in May 1901, also on the downs by the sea between Mehedia and Rabat in March 1902.
In spring in the north of Marocco, where there appears to be no summer brood.

36. *Cœnonympha lyllus*, Esp.

Very numerous south of Rabat, and throughout the south of Morocco, ascending the Great Atlas to at least 10,000 ft. during the summer.

Imentalla, July 9th, 1901, 5,500 ft. Amsmiz, June 16th, 1901.

37. *Cœnonympha vaucheri*, Blachier. Bull. Soc. Ent. France, 1905, p. 213. (*C. meade-waldoi*, n. sp. Elwes MS.)*

Plate XIX, fig. 1, ♂, 2, ♀.

It was abundant on the more barren stony places near the top, but none occurred amongst the broom-covered slopes lower down.

Fairly common on Tsauritz Entsagauz, and very abundant on Tizi Gourzá up to the top of the mountains. Seen nowhere else. Tsauritz Entsagauz, July 6th. Tizi Gourzá, July 11th, 1901.

I may incidentally add that the top of Tizi Gourzá is entirely stone boulders and great slabs of rock for the last 500 ft., and on reaching the extreme summit we saw a hollow place beneath a great slab, in this were some bits of rag held down by stones, and from the top fluttered some white rags from a stick jammed in between the rocks. It was a holy place, and our susi, Hammoo, the only one of our Moors who would accompany us, crept in, lay down on his face and prayed.

["This is a very distinct species which can be mistaken for no other, and on account of the extreme difficulty of reaching the place where it was found is likely to remain very rare in collections. I do not know with what species to compare it, and as the figures will show its characters better than any description I will only say that it seems to be the most Alpine species found in the Southern Atlas, for although Mr. Meade-Waldo saw many other insects as high up on the mountain, he never saw this butterfly except at a very considerable elevation, certainly not below 8,500 ft."—*H. J. E.*]

38. *Thecla ilicis*, Esp., var. *mauritanica*, Stgr.

Abundant everywhere where cork oak and prickly oak occur.

Bushārin, May 16th. Ras Doura, May 18th. Tsauritz Entsagauz, 1901.

* Mr. Meade-Waldo's specimens of this new and very interesting Satyrid in the Natural History Museum, from which the figures on Plate XIX have been drawn, agree in all respects with M. Blachier's description of *C. vaucheri*, and I have therefore adopted this name. —*J. J. W.*

["This seems to agree best with the form described by Staudinger from North Africa '*minor subtus obscurior fere unicolor*,' but it varies greatly, and some specimens might be referred to *T. acaciæ*."—*H. J. E.*]

39. *Callophrys rubi*, L.

I only saw it in the north of Marocco, where it was common in early spring almost everywhere.

Tangier, March 26th, 1901; March 13th, 1902.

40. *Chrysophanus thersamon*, Esp., var. *omphale*, Klug.

I only took one worn specimen on the outskirts of Marocco City on June 12th. This species has not, as far as we know, been previously taken in Africa.

41. *Chrysophanus alciphron*, Rott., var. *gordius*, Sulz.

I only saw it in the Atlas, where it did not seem common; it was probably going over, as I only took two specimens that were fresh.

Tizi Gourzá, July 11th. Tsauritz Entsagauz, July 6th, 1901.

["This also has not previously been recorded from North Africa; the male has no violet sheen on the upper surface."—*H. J. E.*]

42. *Chrysophanus phlæas*, L.

Common and universal, extremely abundant locally, subject to great variation, and is out all the year.

Tangier, March 10th, 1901. Tangier, Feb. 27th, 1901. Marrākesh, June 10th, 1901.

43. *Thestor mauritanicus*, Luc.

Common, but extremely local; is on the wing for only a short time in early spring.

Tangier, March 11th. Bubāna, March 27th. Hawara, April 4th, 1901. Larva feeds on the pod of a leguminous plant.

44. *Thestor ballus*, Fabr.

Is as the last, but not quite so local, and is also on the wing earlier and a little later.

Tetuan, January 16th. Tangier, March 6th. Hawara, April 4th, 1901.

45. *Lampides bæticus*, L.

Fairly common and on the wing all the summer. I saw a worn specimen in December 1900.

46. *Lampides telicanus*, Lang.

Commoner than the last, and out earlier.
Tangier, July 13th. Rabat, May 26th. Rehamma, June 9th, 1901.

47. *Lampides theophrastus*, Fabr.

I only saw this species south of Ouad Moorbey from where it reached the foothills of the Atlas, and was abundant wherever the Jujube bush (*Zizyphus lotus*) grew.
Moorbey, June 6th. Anzoot, July 14th, 1901.

48. *Lampides jesous*, Guér.

The distribution the same as the last, but most common in the valley of the Ouad Moorbey.
Moorbey, June 5th. Below Agūrgūr, June 21st, 1901.

49. *Lycæna lysimon*, Hübn.

I saw a few at Busharin, and it swarmed over some pools of water outside Marrákesh.
Busharin, May 16th. Marrákesh, June 12th. Amsmiz, June 27th, 1901.

50. *Lycæna baton*, Berg., var. *abencerragus*, Pier.

I only saw one specimen below Sould Jedid.
Amsmiz, June 28th, 1901.

51. *Lycæna icarus*, Rott.

Fairly universal, but not remarkably common. From Tangier in August, and various places up to 9,000 feet.
Tangier, August 17th. Busharin, May 16th. Sould Jedid, July 13th. Imentalla, July 8th, 1901.
["Many specimens have spots on the hind margins, and might be called var. *celina*, Aust., but this var. is evidently inconstant."—*H. J. E.*]

52. *Lycæna astrarche*, Bergstr.

Almost universal at all elevations, and in the plains, positively swarming in some woods.

Bershid, May 30th. Imentalla, July 9th. Ouad Moorbey, June 9th. Tangier, April 3rd, 1901. Only found in summer, and as usual in hot regions very brown below (var. *calida*, Bell).

53. *Lycæna hylas*, W. V.

I only saw this butterfly on Tsauritz Entsagauz, and at Imentalla, where it was extremely abundant on the top, of a low mountain, 5,500 feet.

Imentalla, July 8th, 1901.

(Plate XIX, fig. 5, ♂, 6, ♀.)

[" Var. *atlantica*, Elwes, n. var.

" This is quite an unexpected discovery in Marocco, and a very interesting one, because though a variety of this species occurs in the higher region of the Sierra Nevada, and in some places in the mountains of eastern Spain, yet the male of this form (*nivescens*, Kef.) is of a grey-blue colour above, whilst the colour of the male of *atlantica* is to my eye like that of typical *hylas*, though Mr. Meade-Waldo sees a difference.

"Some males have marginal black spots on the hind-wing above, and both sexes have the white stripe on hind-wing beneath, broad and well marked. All the females have a broad band of orange marginal markings on the fore-wings which I have never seen so well marked in any European *hylas*."—*H. J. E.*]

54. *Cyaniris argiolus*, L.

Appears first in February, and at intervals throughout the summer.

Tangier, February 20th. Amsmiz, June 26th. Tangier, August 28th, 1901.

55. *Adopæa thaumas*, Hübn.

Tsauritz Entsagauz, 9,000 ft., June 1901. Common.

56. *Adopæa actæon*, Rott.

Ras Doura, May 1901. Common.

57. *Adopæa hamza*, Obth.

Rabat, May 26, 1901. Common.

58. *Parnara zelleri*, Led.

Local and scarce, frequents wet places in woods, flies extremely fast.

Bashasin, May 20th. Tangier, August 30th, 1901.

59. *Parnara nostrodamus*, Fab.

Extremely abundant locally in late summer in open stony places.
Tangier, August 28th, September 2nd, 1901.

60. *Carcharodus alceæ*, Esp.

Imentalla, 5,000 ft. July 1901, Common.

61. *Carcharodus althææ*, Hübn.

Plains of Marocco, rather scarce.
Mehedia, May 1901.

62. *Hesperia ali*, Obth.

I only saw a few on low ground.
Tangier, August 30th, 1901.

63. *Hesperia serratulæ*, Ramb.

[" Though I do not profess to know how *serratulæ* can with certainty be distinguished from *alveus* without studying the genitalia, which in this case I have not done, yet these specimens from Imentalla and Agūrgūr appear to me to belong to *serratulæ*, though according to Staudinger *onopordi* of Rambur is the form found in Marocco."—*H. J. E.*]

Moths collected in Marocco. By E. G. B. Meade-Waldo.

ARCTIADÆ.

Arctianæ.

1. *Euprepia cribraria*, Linn., Syst. Nat., i, p. 507 (1758).

Forest of Marmora. The variety *punctigera*, Frr., *L. candida*, Cyr.
March 26th, 1902. Ensar, Kabyla amar, Forest of Marmora.

2. *Arctia villica*, Linn., Syst. Nat., i, p. 501 (1758).

All the specimens belong to the form *koncwkai*, Freyer.
Abundant in April at Sharf-at-Akab, Tangier.

3. *Cymbalophora pudica*, Esp., Schmett., iii, p. 177, pl. 33, f. 1 (1784).

Abundant in August and September. The larva, which feeds on various grasses, spins a slight cocoon in the

bottom of thick herbage, but remains in its larval state until within about fourteen days of emerging.

4. *Utethesa pulchella*, Linn., Syst. Nat., i, p. 534 (1758).

Locally and sporadically very abundant in August and September.

NOCTUIDÆ.

Agrotinæ.

5. *Chloridea dipsacea*, Linn., Syst. Nat., xii, p. 856 (1766).

Forest of Marmora.
Very common the end of March. Flying by day, 1902.

6. *Chloridea peltigera*, Schiff., Wien Verz., p. 89 (1776).

Distributed throughout the central plains of Marocco. June and July, 1901.

7. *Euxoa segetis*, Schiff., Wien Verz., ii, 81, 252, ff. 3. a. b. (1776).

Common at Tangier in spring and autumn.

8. *Euxoa spinifera*, Hübn., Samml. Eur. Schmett. Noct, f. 389 (1827).

Tangier.

9. *Agrotis ypsilon*, Rott., Naturf., ix, p. 141 (1776).

Tangier, May 1901.

10. *Agrotis comes*, Treit., Schmett. Eur., v, 1, p. 254 (1825).

Tangier. One specimen.

11. *Agrotis pronuba*, Linn., Syst. Nat., i, p. 512 (1758).

The only one seen, September 1901.
Tangier. Two specimens.

12. *Agrotis c-nigrum*, Linn., Syst. Nat., x, p. 516 (1758).

Bred from dug pupa, March 1902.

13. *Episilia faccta*, Treit., Schmett. Eur., x, 2, p. 35 (1836).

Very common at Tangier throughout the winter.

14. *Lycophotia margaritosa,* Haw., Lep. Brit., p. 218 (1809).

Bred from dug pupa, March 1902.

HADENINÆ.

15. *Mamestra oleracea,* Linn., Syst. Nat., ed. x, p. 517 (1758).

Bred from dug pupa, March 1902.

16. *Mamestra chrysozona,* Bork., Eur. Schmett., iv, p. 264 (1792).

Forest of Marmora, Ensar. Forest of Marmora, April 1902.

17. *Leucania l-album,* Linn., Syst. Nat., ed. xii, p. 850 (1766).

Ensar. Forest of Marmora, April 1902.

18. *Leucania loreyi,* Dup., Lep. Fr., vii, 1, p. 81, pl. 105, f. 7 (1827).

Central plains, June 1901.

19. *Glottula pancratii,* Cyr., Ent.Neap., pl. 12, f. 4 (1787).

Tangier.

CUCULLIANÆ.

20. *Cucullia chamomillæ,* Schiff., Wien Verz., p. 73 (1776).

Very abundant in January and February, 1902.

21. *Cucullia tanaceti,* Schiff., Wien Verz., p. 73 (1776).

Tangier.

22. *Bombycia viminalis,* Fabr., Gen. Ins., p. 284 (1777).

Forest of Marmora.
Came to light on March 28th, 1902.

23. *Cleophana dejeani,* Dup. Lep. Fr., vii, p. 115 (1827).

Came to light at Sharf-at-Akab, Tangier, April 1901.

24. *Cleophana pauli,* Staud., Iris., iv, p. 306, pl. 4, f. 4 (1891).

(Plate XIX, fig. 11, ♀.)

Forest of Marmora, April 27th. Flying by day.

25. *Cleophana diffluens*, Staud., Berl. Ent. Zeit. 1870, p. 121.

(Plate XIX, fig. 12, var. *maroccana*, ♂.)

Forest of Marmora, at light March 27th, 1902. The variety *maroccana*.

26. *Metopoceras felicina*, Donz., Ann. Soc. Ent. Fr., 1844, p. 199, pl. 6, f. 2.

Forest of Marmora, at light March 27th, 1902.

ACRONYCTINÆ.

27. *Brotolomia meticulosa*, Linn., Syst. Nat., p. 513 (1758).

Only saw three in Marocco, March 1901.

28. *Euplexia solieri*, Boisd., Ind. Meth., Errat., p. 4 (1829).

Tangier, September 1901.

29. *Acronycta rumicis*, Linn., Syst. Nat., p. 516 (1758).

Tangier.

30. *Acronycta megacephala*, Fabr., Mant. Ins., p. 175 (1787).

Tangier, September 1901.

31. *Laphygma quadripunctata*, Fabr., Syst. Ent., p. 594 (1775).

Tangier.

32. *Amphipyra eriopoda*, Herr.-Schäf., Eur. Schmett, ii, p. 413, f. 596 (1851).

Tangier.

CATOCALINÆ.

33. *Catocala conversa*, Esp., Schmett., f. 105 (B) 1-2 (1787).

Tangier. The variety *ayamos*, Hübn.

34. *Catocala oberthuri*, Aust., de. Nat. 1879, p. 85.

Very common, August and September. Tangier.

35. *Ophiusa tirrhæa*, Cram., Pap. Exot., ii, p. 116, pl. 172, E (1780).

Not common, Sharf-al-Akab. Tangier, April 1901.

36. *Ophiusa algira*, Linn., Syst. Nat., ed. xii, p. 836 (1766).

Tangier.

37. *Ophiusa lunaris*, Schiff., Wien. Verz., p. 94 (1776).

Forest of Marmora. March 28th, 1902.

38. *Grammodes geometrica*, Fabr., Syst. Ent., p. 599 (1775).

Tangier.

39. *Grammodes stolida*, Fabr., Syst. Ent., p. 599 (1775).

Tangier.

PLUSIANÆ.

40. *Plusia gamma*, Linn., Syst. Nat., i. p. 513 (1758).

Abundant everywhere.

NOCTUINÆ.

41. *Apopestes spectrum*, Esp., Schmett., iv, p. 131, pl. 100, ff. 3, 4 (1786).

Common at Tangier in summer. These specimens were bred from pupa found in May, near Fedulla, on the West Coast. The white silk cocoons were abundant, and attached to *Euphorbia* on the sea coast.

ERASTRIANÆ.

42. *Callopistria latreilli*, Dup., Lep. Fr., vii, p. 329, pl. 120, f. 2 (1827).

Taken on Olive, above Amsmiz in the Great Atlas (1901).

43. *Tarache lucida*, Hübn., Berl. Mag., iii, p. 302 (1767).

Very common, on the plain near Fedulla in May 1901. The variety *albicollis*, F.

44. *Tarache luctuosa*, Esp., Schmett., pl. 88, f. 4 (1786).

Tangier.

45. *Eublemma ostrina*, Hübn., Eur. Schmett. Noct., f. 399 (1827).

Tangier, February 1902.

HYPENINÆ.

46. *Zanclognatha crinalis*, Treit., Schmett. Eur., vii, p. 17 (1829).

Tangier, February 1902.

47. *Hypena obsitalis*, Hübn., Eur. Schmett. Pyr., ff. 164–165 (1827).

Tangier.

48. *Hypena lividalis*, Hübn., Beitr., ii, 4, pl. 1, E (1827).

Tangier, December 1901.

Lymantriadæ.

49. *Euproctis chrysorrhœa*, Linn., Syst. Nat., p. 502 (1758).

Tangier.

50. *Lymantria dispar*, Linn., Syst. Nat., p. 501 (1758).

Tangier.

51. *Lymantria atlantica*, Ramb., Faun. And., pl. 15, f. 7 (1838).

Tangier.

SPHINGIDÆ.

Acherontianæ.

52. *Acherontia atropos*, Linn., Syst. Nat., i, p. 490 (1758).

Tangier.
The only one seen or heard of, September 1901.

Ambulicinæ.

53. *Smerinthus populi*, Linn., Syst. Nat., p. 489 (1758).

Tangier. The variety *austauti* ab. *incarnata*.

Chœrocampinæ.

54. *Deilephila lineata*, Fabr., Syst. Ent., p. 541 (1779).

April and May, flying by day as well as in evening. Tangier.

55. *Chœrocampa celerio*, Linn., Syst. Nat., i, p. 491 (1758).

Very common. Tangier in September, comes to *Plumbago* at sunset.

MACROGLOSSINÆ.

56. *Macroglossa stellatarum*, Linn., Syst. Nat., i, p. 493 (1758).

Very abundant everywhere.

NOTODONTIDÆ.

57. *Dicranura vinula*, Linn., Syst. Nat., i, p. 499 (1758).

Tangier, 1901.

Saw many old cocoons on Aspen and Willow, but only two containing living pupæ, from one of which this species emerged.

58. *Phalera bucephala*, Linn., Syst. Nat., p. 508 (1758).

Tangier. The variety *bucephalina*.

GEOMETRIDÆ.

BOARMIANÆ.

59. *Opisthograptis luteolata*, Linn., Syst. Nat., p. 525 (1758).

Tangier.

60. *Eurranthis pennigeraria*, Hübn., Eur. Schmett., Geom., f. 363 (1827).

Akba Hamra. The variety *chrysitaria*, H. G.

61. *Aspilates ochrearia*, Rossi., Mant., ii, p. 53, pl. 7, N (1794).

Forest of Marmora. Metradia. Ras Doura.
Abundant; a day-flyer. March 1902.

62. *Amygdaloptera testaria*, Fabr., Ent. Syst., p. 143 (1794).

Forest of Marmora.
Abundant; a day-flyer. March 1902.

63. *Fidonia famula*, Esp., Schmett., iv, pl. 106, f. 4 (1787).

Forest of Marmora. In extraordinary abundance. March 1902.

64. *Thamnonoma gesticularia*, Hübn., Eur. Schmett. Geom., ff. 472–3 (1827).

The only specimen seen. February 1902. Tangier.

65. *Thamnonoma semicanaria*, Frr., Beitr., 78, 2, 1, p. 145 (1833).

Tangier, Bubana. March 1901.

66. *Selidosema ericetaria*, Vill. Linn., Ent., ii, p. 329, pl. 6, f. 9 (1789).

Tangier.

67. *Gnophos asperaria*, Hübn., Eur. Schmett., Geom., f. 484 (1827).

Tangier. March 1902.

68. *Boarmia* (?) *gemmaria*, Brahm., Ins. Kal., ii, p. 255 (1791).

More uniform above, and more fulvous below, than the typical form.

The only one seen March 1902. Tangier.

69. *Boarmia abietaria*, Goeze, Beitr. iii, 3, p. 439 (1781).

Forest of Marmora. March 27th, 1902.

70. *Boarmia abruptaria*, Thnb., Diss. Ent., iv, p. 59, pl. iv, f. 8 (1792).

Very common in winter at Tangier.

71. *Boarmia atlanticaria*, Staud., Stett. Ent. Zeit., 1859, p. 218.

Only one taken, March 1902. Tangier.

Larentianæ.

72. *Sterrha sacraria*, Linn., Syst. Nat., ed. xii, p. 863 (1766).

Tangier.

73. *Anaitis plagiata*, Linn., Syst. Nat., i, p. 526 (1858).

Common at Tangier in winter.

74. *Cidaria malvata*, Rmbr., Ann. Soc. Ent. Fr., 1832, p. 43, pl. 2, f. 5.

Tangier. October 1901, only one seen.

75. *Cidaria siterata*, Hübn., Berl. Mag., iv, p. 522 (1769).

Tangier, February 4th, 1902. Given me by Lord Walsingham.

76. *Cidaria basochesiata*, Dup., Lep. Fr., viii, 1, p. 559, pl. 210, f. 5 (1831).

Tangier. February 2nd, 1902. Given me by Lord Walsingham.

77. *Eupithecia oblongata*, Thnb., Diss. Ent., i, p. 14, f. 12 (1784).

Near Tangier, at Ain Zeitun. February 1902. Common.

GEOMETRINÆ.

78. *Pseudoterpna coronillaria*, Hübn., Eur. Schmett., Geom., ff. 479–482 (1827).

Near Tangier, at Ain Zeitun. February 1902.

ACIDALIANÆ.

79. *Rhodostrophia sicanaria*, Zell., Stett. Ent. Zeit., 1852, p. 180.

Atlas Mountains, Imentalla. 5,000 feet. July 9th, 1901.

80. *Ephyra pupillaria*, Hübn., Eur. Schmett., Geom., f. 69 (1827).

Bred from larva. March 1901.

81. *Acidalia perpusillaria*, Ev., Bull. Mosc., 1847, iii, p. 82, pl. 6, f. 7.

Given me by Lord Walsingham, February 1902.

82. *Acidalia elongaria*, Rmbr., Ann. Soc. Ent. Fr., 1833, 38, pl. 2, f. 20.

Tangier. March 1901.

83. *Acidalia subsericeata*, Haw., Lep. Brit., p. 352 (1809).

Forest of Marmora. March 1902.

LASIOCAMPIDÆ.

84. *Taragama repanda*, Hübn., Eur. Schmett., Bomb., ff. 274–5 (1827).

The larva of this species may be found in all stages of growth all the year round, with perhaps the exception of the months of August and September; it varies remarkably in colouring, individuals being found in all shades of grey and brown to black with violet dots. It will feed on almost anything, but a prickly broom, *Genista tricuspidata*, appears its favourite food plant; it is very abundant in the neighbourhood of Tangier, and I also saw it at Tetuan and Rabat.

85. *Pachygastria trifolii*, Schiff., Wien Verz., p. 57 (1776).

The same remarks practically apply to this larva, which may be found universally in numbers all the year round. It is much more abundant than the last, and varies greatly in colour; it will feed on almost anything.

86. *Macrothylacia rubi*, Linn., Syst. Nat., ed. x, p. 498 (1758).

Subsp. *digramma*, Meade-Waldo, subsp. n.

(Plate XIX, fig. 10, ♀.)

Deep red-brown: antennæ ochreous-white above. Fore-wing with fine oblique white antemedian line from subcostal nervure to vein 1, very slightly excurved below the cell: a fine white postmedian oblique line arising from vein 10, incurved to above 7, excurved to vein 2, then straight to inner margin. Differs from the typical form in the uniform dark chocolate colour, the white lines of fore-wing being fine and farther apart, and the uniform chocolate ciliæ of both wings. Exp. 86–94 mm.

Hab. Tangier.

I also took plenty of larvæ at Babara. It frequents large tracts of *Lentiscus* and ilex scrub. The larva feeds on *Pistacia lentiscus* and *Quercus ilex*; it hibernates curled up in December, spins a slight cocoon in March, and emerges the beginning of April. Although carefully sought for we never saw a male. I only saw one form of larva, dark chocolate brown.

87. *Malacosoma franconica*, Esp., Schmett., pl. 26, f. 1–2 (1784).

Tangier.

COSSIDÆ.

88. *Zeuzera pyrina*, Linn., Faun. Suec., p. 306 (1761).

Tangier.

PSYCHIDÆ.

89. *Oreopsyche albida*, Esp., Schmett., ii, p. 391, pl. 78, f. 2 (1787).

The variety *lorquiniella*, Bruand.

Common in the forest of Marmora, March 1902, flying by day, and attracted apparently by the dead birds, etc., that were lying by us as we sat at lunch, hovering over them and possibly mistaking their smell for that of the female.

ZYGÆNIDÆ.

90. *Zygæna carniolica*, Scop., Ent. Carn., p. 189 (1763).

The variety *orana*, Dup.

Laraishe, April 3rd, 1902.

91. *Zygæna favonia*, Frr., Beitr. Eur. Schmett., v, p. 76, pl. 428, f. 1 (1845).

Zygæna aurata, Blachier, Bull. Soc. Ent. Fr., 1905, p. 213.

Two varieties (1) *aurata* mostly clothed with fulvous to whitish hair, the abdomen with two crimson bands on terminal segments, the fore-wing pale brassy golden yellow. (2) *favonia*: thorax with few whitish hairs; abdomen with one crimson band, fore-wing blackish. Very abundant at great heights on the Atlas, up to 12,400 ft., in July on Tizi Gourzá.

92. *Procris orana*, Aust., de. Nat. ii, p. 284 (1880).

Taken on grass at Imi Ouern on a branch of the Ouad Amsmiz, July 11th, 1902, about 9,000 ft.

PYRALIDÆ.

SCHÆNOBIANÆ.

93. *Scirpophaga prælata*, Scop., Ent. Carn., No. 198 (1763).

Ras Doura. April 1st, 1902.

Phycitinæ.

94. *Myelois cribrella*, Hübn., Eur. Schmett., Tin., f. 67 (1827).

Ras Doura. April 1st, 1902.

95. *Acrobasis porphyrella*, Dup., Lep. Fr., x, p. 191, pl. 279, f. 2 (1836).

Forest of Marmora. March 7th, 1902.

Pyralinæ.

96. *Cledeobia interjunctalis*, Guen., Luc, Expl. Alg., p. 398 (1848).

Ras Doura. April 1st, 1902.

Hydrocampinæ.

97. *Nymphula stratiotata*, Linn., Syst. Nat., i, p. 529 (1758).

Forest of Marmora. March 1902.

Pyraustinæ.

98. *Phlyctænodes palealis*, Schiff., Wien Verz., p. 123 (1776).

Forest of Marmora. March 1902.

99. *Mecyna polygonalis*, Hübn., Vog., p. 76 (1827).

Forest of Marmora. March 1902.

100. *Pyrausta flavalis*, Schiff., Wien Verz., p. 121 (1776).

The Atlas.

Explanation of Plates XVIII, XIX.

Plate XVIII.

Sketch map showing Mr. Meade-Waldo's route in Marocco.

Plate XIX.

Fig. 1. *Cœnonympha vaucheri*, ♂, p. 377.
2. „ „ ♀, p. 377.
3. *Satyrus mniszechi*, var. *maroccana*, ♂, p. 375.
4. „ „ „ „ ♀, p. 375.
5. *Lycæna hylas*, var. *atlantica*, ♂, p. 380.
6. „ „ „ „ ♀, p. 380.
7. *Euchloë eupheno*, ♀ var. *androgyne*, p. 372.
8. *Teracolus daira*, var. *nouna*, ♂, p. 372.
9. „ „ „ „ ♀, p. 372.
10. *Macrothylacia rubi*, subsp. *digramma*, ♀, p. 390.
11. *Cleophana panti*, ♀, p. 383.
12. *Cleophana diffluens*, var. *maroccana*, ♂, p. 384.

XXII. *A new species of the Hymenopterous Genus* Megalyra, Westwood. By J. Chester Bradley, Ithaca, N.Y., U.S.A. Communicated by Col. C. T. Bingham, F.Z.S.

[Read November 1st, 1905.]

I find among some material from the American Museum of Natural History an undescribed species of *Megalyra*. In order that its position may be readily seen I append a translation of a table to the genus published by Szepligeti in the "Természetrajzi Füzetek," xxv, p. 526, adding the new species in its proper place.

1. Wings black, short, scarcely longer than the head above. *Mutilis*, Westwood.
   Wings not shorter than normal . . . . . (2)

2. Wings black or brown . . . . . (3)
   Wings hyaline, with brown crossbands . . . . (5)

3. Wings black, almost opaque, with a hyaline spot; forehead and vertex longitudinally grooved . . *Shuckardii*, Westwood.
   Wings more or less brown, without a hyaline spot; forehead and vertex not longitudinally grooved . . . (4)

4. Entirely black; head, venter, legs, and propodeum heavily clothed with grey hair; a hairy spot on the side of each abdominal segment . . *Melanoptera*, Schletterer.
   Base of the antennæ, legs beyond the femora, and the abdomen red; not heavily clothed with hair; the abdomen without hairy spots . . . . . *Rufiventris*, Szepligeti.

5. The posterior ocelli further removed from each other than from the compound eyes . . . . . (6)
   The posterior ocelli equally removed from the compound eyes and from each other . . . . . (7)

6. Entirely black ; scutellum coarsely punctured, smooth mesally ; the first and a narrow margin on the second and third dorsal segments smooth and polished, the rest shagreened by minute punctulations . . . . . *Szepligetti*, n. sp.
   Dark brown with reddish areas, the anterior legs beyond the femora and the posterior beyond the tibiæ reddish-brown ; scutellum longitudinally wrinkled ; abdomen not sculptured as above . . . . . *Caudata*, Szepligeti.

7. Cheeks thickly and rather coarsely punctured ; terebra about three times as long as the body . . *Fasciipennis*, Westwood.
   Head equally punctured all over, finer than on the mesonotum ; head red ; terebra four times as long as the body.
   Longiseta, Szepligeti.

Megalyra szepligetii, n. sp.

♀. Entirely black. Slightly pubescent, the truncature of the propodeum tomentose. Head globular, the occiput broad behind the eyes, the posterior margin rounded ; antennæ inserted below the base of the eyes, a lateral oblique groove on each side marked by a high ridge above receiving the scape when pressed downwards, and separating the face from the cheeks and forehead ; head except face rather coarsely closely not deeply, umbilicately reticulate-punctate. Prothorax concealed ; mesonotum convex, produced laterally into two anterior blunt angles ; dorsum punctured similarly to the head, but punctures larger, a sub-smooth area in the middle of the scutellum ; pleuræ more finely punctured, venter much more finely and shallowly punctured ; distinct oblique grooves in the pleuræ for the reception of the anterior and middle femora ; propodeum indefinitely shallowly reticulate ; seen from above the posterior margin is concave, the lateral angles sharp ; the posterior face of the propodeum is concave, the abdomen fitting into it.

Posterior legs covered evenly with well separated punctures ; the coxæ and trochanters short, the femora stout, the single spine on the apex of the tibia reduced to a mere rudiment, the metatarsus longer than the other tarsal joints united, the fourth joint about one half as long as the third ; middle and posterior and to some extent the anterior legs covered with sparse long white hairs, about as long as the third tarsal joint.

Wings hyaline, a broad brown band extending all the way across at the stigma, a slightly dark spot at the apex ; the free part of M_4 and the spur of the transverse part of M_2 wanting.

Abdomen sessile but constricted, the first dorsal segment and a very narrow apical margin on the second and third smooth,

impunctate, and polished, the remaining dorsal segments shagreened by very minute punctulations.

Length 12 mm. ; of the head and thorax 6·5 mm. ; of the abdomen 5·5 mm. ; of the fore-wing 9 mm. ; of the ovipositor 34 mm.

Hab. South Australia.

Type.—1 ♀ in the collection of the American Museum of Natural History in New York City.

A fine specimen of *Megalyra melanoptera*, Schletterer, from New South Wales is also contained in that collection.

XXIII. Hymenoptera aculeata *collected in Algeria by the* Rev. A. E. Eaton, M.A., F.E.S., *and the* Rev. Francis David Morice, M.A., F.E.S. *Part II.* Diploptera. By Edward Saunders, F.R.S., etc.

[Read November 15th, 1905.]

Jugurthia numida, Sauss.

♂. Biskra, in grounds of Château Landon, 8.10 a.m., 24, v, 93. (*A. E. E.*)

♂. „ between Fort St. Germain and the brick kiln on *Ammi visnaga* in the afternoon, 19, v, 97. (*A. E. E.*)

♀ „ between Fort St. Germain and the brick kiln on *Ammi visnaga*, in the afternoon, 18, vi, 97. (*A. E. E.*)

♀. Médéa, Route d'Alger, north of town, on low plants, such as *Convolvulus arvensis*, *Malva sylvestris* and *Echium*, 26, vi, 93. (*A. E. E.*)

♀. „ wood towards Kef-el-azeri, on *Daucus setifolius*, 2, viii, 93. (*A. E. E.*)

Celonites fischeri, Spin.

♀. Koudia Sma, a hill east of Médéa, alt. abt. 3,180 ft., on *Microlonchus salmanticus*, 15, vii, 93. (*A. E. E.*)

♀. Constantine, visiting *Echium italicum*, "rolls itself into a pill and shams death," 21, v, 95. (*A. E. E.*)

♂♀. Biskra, on *Echium humile*, 19, v, 97, and 18, vi, 97 (*A. E. E.*)

Quartinia major, Kohl.

♀ 4. Sidi Ferruch, about sixteen miles from Algiers westwards on the coast, on the glacis of the fort, resting on flowers of *Asteriscus maritimus*, 8, v, 93. (*A. E. E.*)

Quartinia dilecta, André.

♀ 1. Biskra, on *Picridium tingitanum*, 3, iv, 97. (*A. E. E.*)

Eumenes sichelii, Sauss.

♂ 1. Biskra, cornlands bordering the route des Zibans on *Ammi visnaga*, Lam., 25, v, 93. (*A. E. E.*)

♂ 1. „ hollows between the railway near Kilométre 199, and the scrub bordering the pasture, 6, v, 97. (*A. E. E.*)

♀ 1. „ scrub bordering the pasture, on *Antirrhinum ramosissimum*, 13, v, 97. (*A. E. E.*)

♀ 2. Tunis in the Cimetière de Sidi-ben-Hassen, 20, xii, 93. (*A. E. E.*)

Eumenes nigra, Brullé.

♀ 2. Road to Hamman-es-Salahin, opposite the new Beni Mora racecourse, visiting *Peganum harmala*, 21, iv, 95. (*A. E. E.*)

Eumenes coarctata, F.

Various localities and dates from April to November. (*A. E. E.* and *F. D. M.*)

Eumenes coarctata, F., var. *dubius*, Sauss.

♀ 1. Ravines, near Mount Ben Omar, north of Médéa, alt. 2,730–3,130 ft., on *Eryngium triquetrum*, 11, vii, 93. (*A. E. E.*)

♀ 1. Bône, on *Mentha rotundifolia*, 10, viii, 97. (*A. E. E.*)

Eumenes picteti, Sauss. var. (?)

♀ 1. Biskra, amongst *Tamarix*, 30, ix, 97. (*A. E. E.*)

Psiloglossa algeriensis, n. sp.

Nigra; rufo flavoque picta; pronotum antice truncatum angulis rectis; post-scutellum sub-lamelliforme lateribus elevatis, apice emarginato, lingua elongata ad coxas intermedias attingens, abdomen segmento primo cupuliformi, margine apicali subelevato.

♂. Black, mandibles, clypeus, scape of antennæ in front, and face from just above the sinus of the eyes, except two short black divergent lines originating at the insertion of the antennæ flavous, flagellum of antennæ beneath, a spot behind each eye, the pronotum except at

its posterior angles, the tegulæ, a spot below the tubercles, the posterior angles of the scutellum, and the raised margin of the post-scutellum flavo-testaceous, abdomen with the 1st segment, except a basal triangular spot, testaceous, the other segments black with a trisinuate testaceous apical band, legs with the apices of the femora, the tibiæ and tarsi rufotestaceous. Head closely and coarsely punctured, mandibles tridentate, clypeus deeply and angularly emarginate, apical joint of the antennæ small, slightly curved and subtruncate; thorax punctured very similarly to the head, prothorax truncate in front, its angles not produced and nearly rectangular; wings slightly dusky especially along the costal margin, nervures brown, clear testaceous towards the base of the wings; 2nd recurrent nervure received near the base of the third submarginal cell; post-scutellum flattened and produced horizontally over the propodeum, slightly emarginate posteriorly, its margins reflexed, a strong carina runs along the sides of the propodeum, below which the surface is bright and shining; abdomen strongly punctured 1st segment cupuliform, its apical margin slightly raised.

♀. Very like the ♂ and similarly punctured, but with the base and under-side of the antennæ, the mandibles, the head posteriorly, and a spot in the sinus of each eye rufotestaceous; on the face, its apex between the insertion of the antennæ, is a triangular spot of a paler testaceous colour, clypeus only slightly sinuate at its apex, pronotum truncate with its angles more produced than in the ♂, and if anything slightly less than a right angle, flavotestaceous in front blending through a brownish colour into black posteriorly; wings as in the ♂. Sides of the propodeum rufotestaceous, abdomen with the basal segment rufotestaceous, its apex of a more flavous tint, its disc with a round blackish spot, the rest of the segments black, with a testaceous trisinuate apical band, more or less margined with rufous, apex of terminal segments entirely testaceous; legs as in the ♂.

Long. 7–8 mm.

♂ 1. Biskra, on *Antirrhinum ramosissimum*, 21, iii, 97. (*A. E. E.*)
♀ 2. „ 22, iv, 97. (*A. E. E.*)
♀ 2. „ on *Atractylis serratuloides*, 10, v, 97. (*A. E. E.*)
♀ 1. „ on *Deverra chlorantha*, 13, v, 97. (*A. E. E.*)

Apparently allied in colour to *P. pulchra*, Mor., but differing in the shape of the pronotal angles and that of the lamelliform post-scutellum.

RAPHIDOGLOSSA RUFESCENS, n. sp.

Rufotestacea, nigro-variegata, clypeo, abdominisque segmento primo et secundo rufotestaceis primo fascia apicali nulla, ♀ clypei marginibus elevatis, nigris ;

Rufotestaceous, head and thorax largely and closely punctured, the former black with the clypeus, a large somewhat triangularly-shaped spot, its base situated just below the anterior ocellus and its apex just above the insertion of the antennæ, and a large spot behind each eye rufotestaceous, mandibles in the centre and antennæ at the base of the same colour, mandibles with four blunt teeth, clypeus in the ♂ bidentate, with a small, deep emargination between the teeth, ♀ with the free sides of the clypeus widely reflexed, shining and black, the apical margin which lies between them slightly emarginate, with two small prominent teeth near the centre. Thorax above, black only on the mesonotum (in one specimen entirely red), and the base of the scutellum and post-scutellum, beneath black with the exception of a red spot on the mesopleura. Pronotum truncate in front meeting the sides in angles slightly less than right angles, the sides slightly sinuate immediately behind the angles which are consequently somewhat produced, post-scutellum truncate posteriorly wings slightly smoky especially towards the costa, veins rufotestaceous, 2nd submarginal cell sub-triangular, very narrowly truncate at its upper margin ; propodeum black in the centre, red and clothed with silvery hairs at the sides ; abdomen dull, finely punctured and clothed with very short white pubescence, with the basal and 2nd segments entirely rufotestaceous, the former strongly punctured, with a large round impression near the apex, and in some examples with the latter more or less suffused with black, following segments black, their posterior margins more or less rufous, sometimes widely so, the colour band of a more or less bisinuate form ; legs entirely rufotestaceous except the anterior coxæ in front.

Long. 15–16 mm.

♂ 2. Biskra, near railway, kilométre 199, "asleep on *Deverra scoparia*, 25, v, 94, holding on to the extreme tips of the stems by the mandibles only, with wings folded longitudinally and widely spread, the legs tucked up close to the body not touching the stems, which waved about in the breeze."

♂ ♀. Biskra ; same locality on *Zizyphus lotus*, 21 and 29, iv, 95.

♂ 2, ♀ 5. Biskra, on *Atractylis serratuloides* and *Antirrhinum ramosissimum*, 6–13, iv, 97.

♂ 2. Biskra, on *Amberboa lippii*, 8, iv, 97.

Several of the above specimens are stylopized (*Xenos*?).

Pterochilus aterrimus, n. sp.

Ater, atrohirtus, punctatus, mandibulis, capite utrinque pone oculos, et in femina interdum clypeo et oculorum orbitis interioribus, tibiis anterioribus antice, articuloque apicali palporum labii, rufo-ornatis; alis valde infumatis.

Black, densely clothed with long black hairs, especially in the ♂, mandibles more or less red, generally nearly entirely so, but in one ♀ with only the extreme apices of that colour, a spot of variable size behind each eye, and in one female two large spots on the clypeus and the inner orbits of the eyes red. Anterior tibiæ in front in both sexes and the much curved, flattened apical joints of the labial palpi of the same colour, wings dark brown with purple reflections. Head and thorax rugosely punctured, somewhat shining, anterior margin of the clypeus narrowly emarginate in the ♂ semicircularly rounded and entire in the ♀; apical joint of labial palpi in the ♀ flat and dilated, fringed with very long hairs, in the ♂ sub-cylindrical with hairs as long as those of the ♀, but finer and less regular. Antennæ in the ♂ slightly rolled at the apex. Penultimate and apical joints very small, especially the latter, posterior wings clearer than the anterior; legs shining, punctured, the inner sides of the first and third pairs of tibiæ densely clothed with fine pubescence in both sexes; propodeum with an angular tooth on each side; abdomen nigro cyaneous, largely punctured on its basal segment which bears a slightly raised tubercle in the centre of its basal brow, finely punctured on the rest, first and second segments in the ♂ first only in the ♀ clothed with long hairs, apical margins of the ventral segments with a row of exceedingly short bristles.

Long. 14–16 mm.

Biskra, ♀ 1, amongst hummocks of *Limoniastrum guyonianum* on the Dunes by the route des Zibans, 19, iii, 94.

♀ 1, visiting *Brassica napus*, 3, iii, 97.

♂ 1, between Biskra and Hamman-es-Salahin.

♂ 3, at rest on dead twigs of *Dæmia cordata* at 5 p.m., holding on by the mandibles and legs; wings divergent, 14, ii, 97.

Pterochilus grandis, Lep.

♀ Médéa, about a mile along the road to Lodi 12.30 to 2.30 p.m., on *Eryngium triquetrum*, 28, vi, 93. (*A. E. E.*)

♀ 1, hill north of railway station, alt. 3,000 feet, 10, vii, 93. (*A. E. E.*)

♀ 1, ravines, near Mount Ben Omar, on *Eryngium triquetrum*, alt. 2,730–3,130 ft., 11, vii, 93. (*A. E. E.*)

♀ 1, on Koudia Sma, a hill to the east, of an altitude of about 2,700 ft., about 4 p.m., 15, vii, 93. (*A. E. E.*)

Pterochilus coccineus, André.

♀ 1. Fontaine Chaude, near Biskra, on the dunes near the stream among *Limoniastrum guyonianum*, 3 to 5 p.m., 16, v, 94.

Pterochilus linguarius, n. sp.

Niger albo et ferrugineo variegatus, lingua longissima ad apicem abdominis extensa, abdominis segmento primo cupuliformi apice elevato, secundo margine posteriore membranaceo, ad basin seriatim punctato-impresso.

Black with white and ferrugineous markings. Head black, shining and strongly punctured, mandibles, scape of the antennæ and the flagellum beneath, testaceous, the latter darker on its upper-side ; Clypeus in the male flavous, in the ♀ sometimes with a testaceous spot, semicircularly emarginate in the ♂, in the ♀ with its free sides reflexed, face densely clothed with silvery hairs in the ♂, sparsely so in the ♀. Tongue very long reaching in repose to the apex of the abdomen, labial palpi slightly flattened and plumose in the ♀, nearly simple in the ♂ : behind the eye in both sexes is a very small whitish spot, antennæ in the ♂ with a sharp reflexed apical joint thorax black, shining, rather remotely punctured pronotum except at its extreme basal angles, tegulæ, a spot on the mesopleura, scutellum except a triangular patch at its base and post-scutellum, ivory white ; prothorax truncate in front, its angles nearly rectangular, legs testaceous, the femora darker at the extreme base, propodeum clothed with silvery white hairs, excavated posteriorly and with a long sharp spine at each side of its extreme apex especially in the ♂ ; on each side there is a testaceous spot of variable size ; abdomen sparsely clothed with silvery hairs, largely and remotely punctured especially on the basal segment which is campanulate in form, its apical margin raised and rounded, entirely testaceous or with its base more or less suffused with black, the raised apical ring ivory white, 2nd segment black with its apical margin flavous the colour spreading at the sides

and sometimes produced on to the disc in the form of two spots, the sides of the segment are generally more or less brown, the apical margin of this segment is produced into a rather wide membrane bearing a row of punctures at the base especially noticeable in the ♂, the following segments are black or piceous with pale apical bands, apical segment black.

Long. 7-8. mm.

♂ 1. Fontaine Chaude, near Biskra, on the dunes near the stream, 9, v, 94. (*A. E. E.*)

♂ 1, ♀ 2. Biskra, Hamman-es-Salahin, on the sandhills, 5, v, 97. (*A. E. E.*)

♀ 3. Biskra, 20 and 31, v, 98. (*F. D. M.*)

A small species superficially like a small *Chevrieranus* but easily distinguished by its extremely long tongue, a character which almost warrants the erection of a new genus for its reception.

Pterochilus affinis, n. sp.

Niger flavopictus, clypeo maris emarginato, feminæ punctato, sine rugis longitudinalibus, apice truncato, alis subluteis, segmentis ventralibus maris 3–5 dense aureofimbriatis, segmenti secundi feminæ disco valde sed sparse punctato.

Black with the following parts yellow, mandibles except their piceous teeth and apices, the entire clypeus in the ♂, the base only in ♀, a spot between the antennæ and a spot behind each eye and another in the sinus of each in both sexes, and the scape of the antennæ in the ♂ a somewhat triangular spot on each side of the prothorax not reaching either the anterior or posterior angle a spot below the wing, the tegulæ, two spots on the scutellum, the post-scutellum and two small spots on the propodeum, the borders of the abdominal segments more or less trisinuately except that of the basal which is straight, and the apical, which has a central spot only ; beneath with a bisinuate band on the second and following segments, except the apical ; all the above markings are the same in both sexes ; legs testaceous-yellow, coxæ, trochanters and bases of the femora black. Head and thorax dull, closely punctured, clothed with long hairs, brownish-red in the ♂, nearly black in the ♀. Clypeus semi-circularly emarginate in the ♂, narrowly truncate in the ♀, spot between the antennæ in the ♂ slightly raised, wings slightly brownish especially along the costa, the nervures testaceous-red. 2nd submarginal cell, receiving both recurrent nervures ; posterior tarsi with their 2nd and claw-joints

subequal in length, the 4th joint about two-thirds as long as the third. Abdomen somewhat shining, very densely and microscopically punctured, the basal segment sparsely clothed with rather long brownish hairs, 3rd, 4th and 5th ventral segments in the ♂ with a dense fringe of short golden hairs.

Long. 13–14 mm.

Bône, ♂ 1. 28, iv, 96. (*A. E. E.*)
Alger, ♀ 1. 29, iv, 98. (*F. D. M.*)

Apparently closely allied to *hellenicus* of Morawitz, but the ♀ differs in having the clypeus destitute of longitudinal rugosities, in having a central spot between the antennæ instead of two side by side, and in having the second segment of the abdomen beneath, with larger punctures scattered on the disk and without the larger punctures on the apical margin. The ♂ of *hellenicus* is not described. The head and thorax are also clothed with longer hairs than in *hellenicus*.

Odynerus (*Hoplopus*) luteolus, Lep.

♂ 2. Médéa, ravines near Mount Ben Omar, alt. 2,730–3,130 feet, 8 to 10 a.m., on *Eryngium triquetrum*, 11, vii, 93. (*A. E. E.*)
♂ 1. Constantine, 16, vi, 98. (*F. D. M.*)

Odynerus (*Hoplopus*) spiricornis, Spin.

♀ 1. Constantine, on M'cid, 21, vi, 94. (*A. E. E.*)
♀ 2. „ „ „ 2, vi, 95. (*A. E. E.*)

Odynerus (*Hoplopus*) consobrinus, Duf.

♂ 2. Algiers, 14 and 17, ii, 93. (*A. E. E.*)
♂ 1. Biskra, about walls of "adobe," village Negre, 13, ii, 94. (*A. E. E.*)
♂ 1. Biskra, visiting *Moricandia arvensis*, 3, ii, 97. (*A. E. E.*)
♀ 1. Biskra, 15, ii, 94. (*A. E. E.*)
♀ 1. Bône, host of *Phileremus oraniensis*, 2, iii, 96. (*A. E. E.*)
♂ 3, ♀ 9. Algiers, March 1898. (*F. D. M.*)

Odynerus (*Hoplopus*) caroli, Mor.

♂ 2. Bône, footpath and river-bank by the Bon Djemma, 24, iii, 96. (*A. E. E.*)

♂ 1., Alger, 27, iv, 98. (*F. D. M.*)
(?) ♀ 1. Constantine, on M'cid, 22, v, 95. (*A. E. E.*)
(?) ♀ 1. Alger, 27, iv, 98. (*F. D. M.*)

The ♂ of this species is known at once by the spine at the base of the anterior femora (beneath). The ♀ which I have assigned to it agrees with it in size and general coloration, and has the post-scutellum rather sharply elevated as in the ♂. It lacks the long hairs of *consobrinus* and *rotundigaster*, but has the yellow band of the second abdominal segment dilated at the sides as in those species, although more distinctly so. The scutellum and post-scutellum are entirely black.

ODYNERUS (*Hoplopus*) DECEPTOR, n. sp.

O. variegato simillimus, ab illo mas coxis intermediis nigro spinosis facile distinguitur, femina, angulis propodei subproductis, segmento secundo abdominis latiori subtus testaceo, minus crebre sed obsoletius punctato aegre distinguenda.

Resembling *O. variegatus* in colour but at once recognizable by the black spines on the intermediate coxæ of the ♂ and the very largely laterally produced bands of the abdomen which on the 1st and 2nd abdominal segments leave only the central basal portion black. In the ♀ (?) of this species the lateral angles of the propodeum although not acute are more produced than in *variegatus*, the 2nd abdominal segment is wider in proportion to the 1st and on its under-side is testaceous, more shining than in *variegatus* less closely and more obsoletely punctured, but only having one example of this ♀ I am unable to say how far these characters are constant.

♂. Head and thorax black, closely punctured, dull, clothed rather sparingly with greyish-brown hairs, clypeus yellow, shining, deeply and semicircularly incised at the apex, labrum yellow, mandibles black, spotted with yellow at the base, a somewhat straight yellow spine projects from the gena on each side of their extreme base; this spine is slightly curved towards the apex and viewed laterally appears nearly truncate, a transverse tubercle between the antennæ and the scape in front testaceous, spire entirely black, pronotum with a ferruginous band not extending to its posterior angles, anterior angles slightly produced and sharp, tegulæ ferruginous, wings smoky, especially along the costal margin, scutellum slightly raised, post-scutellum nearly perpendicular, ferruginous, slightly concave and very shining, sides of the propodeum obtusely angled, its concavity dull, diagonally striate, widely channelled, with a narrow longitudinal carina running along the bottom of the channel—legs

testaceous femora black at the base, intermediate coxæ each bearing a black, slender, nearly straight spine. Abdomen slightly shining very finely rugulose with the first segment clothed with hairs as the thorax, the rest glabrous, all the segments bearing broad bisinuate apical testaceous bands, the bands of the 1st and 2nd segments so produced at the sides towards the base, as to leave a square black central emargination, segments beneath very finely and closely punctured, 2nd with a free testaceous spot on each side in some specimens, often wanting.

♀ (?) The female which I associate with the ♂ has exactly similar bands on the abdomen, and is very similar otherwise, with the exception that the scutellum is ferruginous except at its extreme base and that the sides of the propodeum have the angles rather produced but obtuse and widely yellow and the 2nd segment of the abdomen beneath is nearly entirely ferruginous, shining, and rather obsoletely punctured, there is also a testaceous line on the lower internal orbit of the eye and a large spot behind nearly on the vertex scarcely indicated in the ♂ and a spot on the mesopleura under the wing.

Long. 10–12 mm.

♂ 4. Bône, 20, iv, 96. (*A. E. E.*)
♂ 3. „ foot-path and river bank by the Bon Djemma, 24, iii, 96. (*A. E. E.*)
♀ 1. Médéa, hill north of railway along the edge of the enclosure on the west side, on *Eryngium triquetrum*, 27, vi, 93. (*A. E. E.*)

ODYNERUS (*Hoplopus*) VARIEGATUS, Fab.

♀ 4. Constantine, 15, 16, vi, 98. (*F. D. M.*)

ODYNERUS (*Hoplopus*) ANGUSTIOR, n. sp.

Angustus, parce griseo-hirsutus niger, scapo antennarum antice flavo, flagello toto nigro, clypeo, tuberculo transverso inter antennas, prothoraceque antice flavis, scutello nigro, immaculato, post-scutello flavo, plano, sub-lævi, basi solo punctato, abdominis segmentis apicibus late flavo-fasciatis, subtus segmento secundo crebre et minute punctato, punctis majoribus intermixtis.

♂. Black, clypeus, labrum, a line along the anterior lower orbit of the eye and a spot behind the eye yellow, antennæ with the scape in front yellow, otherwise entirely black. Thorax with the anterior margin of the pronotum, the colour widened at the sides but not produced to the posterior angles, the tegulæ and post-scutellum testaceous, abdomen with a wide, angularly emarginate band on the basal

segment, a wide nearly straight band on the 2nd and a very slightly bi-sinuate band on the 3rd to 6th testaceous. These bands are all continuous on the ventral segments. Legs testaceous yellow, base of the anterior femora above, about three-fifths of the intermediate femora above, and the posterior femora, except at the apex, black.

Head and thorax closely and rugosely punctured, clothed with short greyish white hairs, clypeus deeply and semicircularly emarginate, pronotum rather produced at the sides and sharply angulated, postscutellum shining, propodeum very declivous, its sides rounded, not much excavated posteriorly, the sides of the excavation irregularly and diagonally striate, wings nearly hyaline, but smoky along the costal margins, nerves and stigma dark brown, abdomen coarsely and irregularly punctured on the basal segment, finely but irregularly on the second, finely closely and regularly on the rest, beneath closely and finely punctured throughout, and with a larger (but still rather fine) puncturation scattered over the surface—observable chiefly on the 2nd and 3rd segments—legs simple.

Long. 9 mm.

A slenderer species than usual but bearing no very marked characters, its entirely black flagellum combined with the wide abdominal bands separate it from any other species I can find described.

♂ 1. Biskra, 21, iii, 95. (*A. E. E.*)
♂ 1. „ 23, iii, 97 on *Tamarix*. (*A. E. E.*)
♂ 1. Bône, 1, v, 96. (*A. E. E.*)

ODYNERUS (*Ancistrocerus*) ATROPOS, Lep.

♂ 2. Biskra, sandy banks bordering the fallow near the market garden by the river and railway near kilométre 199, 17, iii, 94.
♂ 4, ♀ 4. Biskra, near the Barrage, 22, iii–iv, 97. "Makes a curved tubular portico to its burrow with irregular elongate longitudinal loopholes; tube 18 mm. long and 3·5 mm. external diameter."

In one ♀ there are 6 submarginal cells in the right wing and 4 in the left, all the other specimens have the normal 3. A character observable in the ♀ which does not appear to have been noticed in descriptions is that the clypeus is practically 3-dentate—as there is a very small tooth in the centre of the emargination.

Odynerus (*Ancistrocerus*) parietum, Linn.

Various localities; Biskra; Bône; Algiers; Azazga, alt. 1,900 ft. (*A. E. E.* and *F. D. M.*)

Odynerus (*Lionotus*) chloroticus, Spin.

♀ 2. Biskra, 31, v, 98. (*F. D. M.*)

Odynerus (*Lionotus*) egregius, H. Sff.

♀ 1. Biskra, 22, iv, 97. (*A. E. E.*)
♀ 1. „ 6, v, 98. (*F. D. M.*)
♀ 1. Médéa, 28, vi, 93. (*A. E. E.*)

Odynerus (*Lionotus*) saussurei, André.

♂ 1, ♀ 2. Biskra, on *Ammi visnaga*, 18–22, vi, 97.

Odynerus (*Lionotus*) dantici, Rossi.

♂ 2. Biskra, on *Ammi visnaga*, 18, v, 93. (*A. E. E.*)
♀ 1. Tizi-Ouzou, on *Zizyphus lotus*, 14, vi, 93. (*A. E. E.*)
♀ 2. Constantine, on *Ferula scabra*, 22, v, and 2, vi, 95. (*A. E. E.*)
♂ 1. Biskra, on *Zizyphus lotus*, 15, v, 97. (*A. E. E.*)
♀ 1. Bône, 25, vii, 97. (*A. E. E.*)
♂ 2, ♀ 6. Biskra, 13, v–10, vi, 98. (*F. D. M.*)
♀ 1. Philippeville, 20, vi, 98. (*F. D. M.*)

Odynerus (*Lionotus*) bidentatus, Lep.

♂ 1. Biskra, railway, near kilométre 199, 31, iii, 94. (*A. E. E.*)
♀ 1. „ Fontaine Chaude, on *Tamarix pauciovulata*, 19, iv, 94. J. Gay MS. (*A. E. E.*)
♀ 1. „ ridge of hills north-east of Hamman-es-Salahin, visits *Ferula vesceritensis*, 5, iv, 95. (*A. E. E.*)
♂ 2. „ visiting *Antirrhinum ramosissimum* 21, iii, 97. (*A. E. E.*)
♀ 1. „ on *Moricandia arvensis*, 12, iv, 97 (*A. E. E.*)

ODYNERUS (*Lionotus*) SPECULARIS, n. sp.

O. bidentato colore assimilis minus hirsutus, post-scutello arcte elevato, crista media subdentata, postice perpendiculari, nitidissimo, propodeo linea dorsali ad basin explanata nitidissima, lateribus utrinque bi-angulatis, squamis magnis subquadratis.

Group of *dantici* and allied to *bidentatus*, Lep.

♂. Black, clothed with short grey hairs, those on the head and front of the thorax rather longer. Head and thorax rugosely punctured, clypeus and labrum flavous, punctured, the former deeply and semi-circularly emarginate, clothed with silvery pubescence, mandibles testaceous, brown at the apex, a spot between the antennæ, the lower anterior orbits of the eyes, a spot behind each eye, and the first two antennal joints flavo-ferrugineous, apical joints of the antennæ including the recurved hook testaceous, at least beneath; pronotum, except its posterior angles, the tegulæ, two transverse spots along the apex of the scutellum, and a spot on each side of the propodeum along the lateral margin yellow, anterior margin of the pronotum very slightly produced in the centre, its angles slightly prominent and rectangular, tegulæ punctured, wings including nerves anteriorly and on the apical half, suffused with brown colour becoming yellower towards the base, post-scutellum sharply elevated with a shining semi-circular area on its perpendicular posterior side, scarcely crenulate, but with a slight central tooth, propodeum angulated at the sides with a strong emargination beneath the larger angle, depression rugosely punctured, but with a very bright shining sub-triangular central space meeting the shining area of the post-scutellum, apical scales very large and subquadrate; abdomen thinly clothed with fine grey pubescence, giving it a greyish look in some lights, rugosely punctured, all the segments with broad yellow trisinuate apical bands, that on the first segment very wide, only leaving a sub-triangular black spot at the base; beneath shining, strongly punctured, with a band on the second and third segments only, basal crenatures of the second segment long and well developed, legs yellow, coxæ and trochanters black, all the former spotted with yellow in front.

Long. 13–14 mm.

♂ 1. Biskra, to the north of railway, kilométre 199, 4.30–6 p.m., on *Teucrium polium*, 28, v, 94. (*A. E. E.*)

♂ 1. „ on *Echinops spinosus*. (*A. E. E.*)

I have described the bands, etc., of this species as yellow, as they are evidently discoloured in both my examples.

Odynerus (*Lionotus*) blanchardianus, Sauss.

♂ 1. Le Tarf, 27, vi, 96. (*A. E. E.*)
♂ 2. Biskra, on *Ammi visnaga*, 15, 17, v, 97. (*A. E. E.*)
♂ 1. Bône, on *Euphorbia paralias*, 7, viii, 97. (*A. E. E.*)
♂ 1. „ „ *Mentha rotundifolia*, 10, viii, 97. (*A. E. E.*)

Odynerus (*Lionotus*) sp. (?)

♀ 1. Biskra, on *Tamarix*, 28, iv, 97. (*A. E. E.*)

Odynerus (*Lionotus*) sp. (?)

♀ 1. Bône, 10, vi, 96. (*A. E. E.*)

Odynerus (*Lionotus*) tripunctatus, Fab.

♀ 1. Biskra, 23, i, 97. (*A. E. E.*)
♀ 1. Biskra, on *Ammi visnaga*, 24, v, 97. (*A. E. E.*)

Odynerus (*Lionotus*) regulus, Sauss.

♂ 3. Bône, on *Euphorbia paralias*, 7 and 23, viii, 97. (*A. E. E.*)
♂ 1. „ „ *Rubus discolor*, 13, viii, 97. (*A. E. E.*)
♂ 1. „ „ *Mentha rotundifolia*, 10, viii, 97. (*A. E. E.*)
♀ 1. „ „ *Juncus acutus*, 25, viii, 97. (*A. E. E.*)
♂ 1. La Calle, 4, viii, 96. (*A. E. E.*)
♂ 1. Biskra, 7, iv, 97. (*A. E. E.*)

Odynerus (*Lionotus*) eatoni, n. sp.

Citrinus, glaber, fortiter punctatus, capitis vertice, mesonoto, sternis, et propodei postice macula centrali nigris; abdominis segmentis primo et secundo nigro maculatis, tegulis magnis, valde punctatis.

Bright citron yellow, glabrous, very largely punctured, head in both sexes with only the vertex black, clypeus narrowly emarginate and bidentate, antennæ sometimes darker towards the apex, apical recurved joint in the ♂ very small; thorax with the mesonotum, except a quadrate spot in front of the scutellum, and the sterna black, propodeum black with its sides yellow, tegulæ large very strongly and closely punctured, wings very slightly dusky rather more so along the costal margin, nervures brown, post-scutellum slightly raised and crenulated, sides of the propodeum rounded and crenulated, apical scale produced above into a long sharp

spine ; abdomen closely but not quite so coarsely punctured as the head and thorax, posterior margin of the 1st segment very slightly and of the 2nd very distinctly raised, a spot on the apical margin of the first segment, a transverse spot on the disk of the 2nd towards the apex black, apical segments sometimes more or less infuscate ; beneath with the 2nd segment convex, its basal costæ rather long but not very strongly developed, legs with the coxæ at the base black.

Long. 8 mm.

A very distinct species by the strongly punctured tegulæ, the peculiar coloration, somewhat resembling *chloroticus*, and the long spines of the apical scales of the propodeum.

♂ 1, ♀ 4. Biskra, cornlands bordering the route des Zibans, on *Ammi visnaga*, 10.30 a.m. and 1–3 p.m., 18 and 24, v, 93. (*A. E. E.*)
♂ 2. Biskra, outskirts of the oasis, 17 and 19, v, 97. (*A. E. E.*)
♂ 1, ♀ 5. Biskra, 5, v–9, vi, 98. (*F. D. M.*)

ODYNERUS (*Lionotus*) DOURSII, Sauss.

♂ 1. Constantine, visiting *Marubium vulgare*, 29, v, 95. (*A. E. E.*)

ODYNERUS (*Lionotus*) PONTEBÆ, Sauss.

♂ 1. Médéa, 28, vi, 93. (*A. E. E.*)
♂ 1. Constantine, 18, vi, 98. (*F. D. M.*)

ODYNERUS (*Lionotus*) PARVULUS, Lep.

Numerous specimens of both sexes from Biskra, Le Tarf, Hippone, Bône, frequently on *Ammi visnaga*, iv–viii. (*A. E. E.* and *F. D. M.*)

ODYNERUS (*Lionotus*) BISPINOSUS, Lep.

♀ 2. Biskra, 28, v, 3, vi, 93. (*A. E. E.*)
♂ 1. Algiers, 13, iv, 98. (*F. D. M.*)
♀ 1. Constantine, 17, vi, 98. (*F. D. M.*)
♀ 1. Biskra, 24, v, 98. (*F. D. M.*)

Odynerus (*Lionotus*) hannibal, Sauss.

♂ 1. Constantine, entering a snail shell "on business," 16, v, 95. (*A. E. E.*)
♂ 2, ♀ 1. Biskra, visiting flowers of *Tamarix brachystylis*, 4 and 8, iv, 95. (*A. E. E.*)
♂ 4, ♀ 4. „ visiting flowers of *Tamarix brachystylis*, 29, iii, 18, iv, 97. (*A. E. E.*)
♀ 1. „ 19, v, 98. (*F. D. M.*)
♀ 1. Constantine, 18, vi, 98. (*F. D. M.*)

Odynerus (*Lionotus*) alpestris, Sauss.

♀ 1. Biskra, Fontaine Chaude, 4, iv, 94. (*A. E. E.*)
♀ 1. „ visiting *Moricandia arvensis*, 25, iii, 95. (*A. E. E.*)
♀ 3. „ visiting *Antirrhinum ramosissimum*, 1 and 21, iii, 97. (*A. E. E.*)
♀ 1. Bône, visiting *Euphorbia paralias*, 23, viii, 97. (*A. E. E.*)

Odynerus (*Lionotus*) floricola, Sauss.

♀ 2. Bône. 6, viii, 96, and 29, vii, 97. (*A. E. E.*)
♂ ♀. Algiers. 22 and 30, iv, 98. (*F. D. M.*)
♂ 1. Le Tarf. 26, vii, 96. (*A. E. E.*)

Odynerus (*Lionotus*), sp. (?)

♂ 1. Biskra and Oued Biskra, above the Barrage, amongst *Tamarix* scrub, 4, iv, 97. (*A. E. E.*)

This male is peculiar in having the claw joints of the intermediate and posterior tarsi black.

Odynerus (*Lionotus*), sp. (?)

♀ 2. Biskra, a little above the Barrage, amongst *Tamarix*, 30, iv, 97. (*A. E. E.*)
♀ 1. „ between the railway and the scrub bordering the pasture, 10, v, 97. (*A. E. E.*)

This may prove to be the ♀ of the preceding, but the tarsi are entirely pale, and both my specimens are much discoloured; they are very closely allied to *floricola*, but the post-scutellum is slightly raised and the mesopleuræ are not carinated under the yellow spot as in that species.

ODYNERUS (*Lionotus*), sp. (?)

♀ 1. Constantine, on *Inula viscosa*, 9, x, 93. (*A. E. E.*)
♀ 1. Philippeville, 20, vi, 98. (*F. D. M.*)

Apparently only differing from the preceding by having the pronotal emargination narrower.

These three species are so closely allied that I do not feel that it would be safe on the material before me to describe them as new.

ODYNERUS (*Microdynerus*) PEDUNCULATUS, n. sp.

Niger, flavo rufoque ornatus; segmento primo abdominali maris petiolato (Eumeniformi), fœminæ formâ consuetâ, in utroque sexu plus minus rufotestaceo, apice flavo fasciato, segmento secundo nigro fascia apicali pallida, ipso apice membranaceo, punctorum serie impressa.

Black, head and thorax shining, strongly punctured, face entirely clothed with silvery hairs in the ♂; mandibles piceous in the ♂, fulvo-testaceous in the ♀, clypeus white in the ♂ except at the apex. Scape of the antennæ in front white in the ♂, fulvo-testaceous in the ♀, recurved apical joint in the ♂ testaceous, terminating in a black knob, reaching to the base of the 11th joint, which is testaceous beneath, the very short 12th joint being entirely of that colour. Anterior margin of the pronotum truncate, with an entire narrow pale band in the ♂, two spots in the ♀, angles nearly right angles, sides of the pronotum nearly parallel, very long in the ♀; tegulæ whitish in the ♂, fulvo-testaceous in the ♀, wings slightly smoky, darker along the costa and in the radial cell, scutellum nearly square in the ♀ and fulvo-testaceous at the apex, transverse in the ♂, with two apical pale spots, post-scutellum black in the ♂, concolorous with the scutellum in the ♀, propodeum black with a strong central impression, its sides clothed with silvery hairs, the impression shining in the ♀, sides of the propodeum gradually converging towards the apex in the male and terminating in two rather long pale spines which somewhat embrace the petiole of the body, sides much more rounded in the ♀, the spines short, and further apart not conspicuously pale, but piceous in colour, propodeal scales small, not spinose; abdomen slightly shining, punctured and clothed with greyish, very fine pubescence, with the basal segment fulvo-testaceous in both sexes, very narrow and petiolate in the ♂, of ordinary form in the ♀, the extreme apex with a pale whitish band, in the ♂ the base of the segment is black, and the apical margin is raised, callose,

and densely fringed posteriorly with very short fine white hairs, second segment with a pale apical band beyond which is a membranous appendix, which in the ♂ bears a row of elongate punctures; beneath with the second segment more shining than the rest and strongly punctured, with the apex pale as on the upper-side. Legs fulvo-testaceous, paler in the ♂, extreme base of the femora piceous.

Long. 7–8 mm.

♀ 1. Biskra, near railway, kilométre 199, in the scrub between the fringe of reeds and the farm mule-track, 22, iv, 97. (*A. E. E.*)

♂ 1, ♀ 1. The same place, 25, iv, 97. (*A. E. E.*)

The ♂ and ♀ are so different in form that I feel great diffidence in uniting them, at the same time their colours are so similar and the locality identical that I hope I have done right; the ♀ is of the ordinary form of a *Microdynerus*, but the ♂ more resembles those species of the *minutus* group, with constricted petioles, *cruentatus*, *eatoni*, etc., but is much more elongate.

Polistes.

Of this widely-distributed genus, numerous specimens have been brought home by Messrs. Eaton and Morice, all of which belong to the gallica group—but the majority are females which in the present state of our knowledge cannot be referred for certainty to their respective males. Dr. F. F. Kohl (Ann. d. K. K. Naturhist, Hofmuseums, Wien, Band xiii, 1898, p. 87, taf. iii) describes and figures the males of five species of this group, which appear to be easily distinguishable, and of these Mr. Eaton has brought home two.

♀♀ are recorded from Biskra, Bône, Médéa, and Mustapha Supérieur. (*A. E. E.* and *F. D. M.*)

Polistes dubia, Kohl.

♂ 2. Biskra, in the grounds of Château Landon, and in the fields between that and The Negro Village, on *Ammi visnaga*, 24, v, 93; "eyes" in life "subolivaceous." (*A. E. E.*)

Polistes fœderata, Kohl.

♂ 1. Bône, near the Plage, 28, xi, 93. (*A. E. E.*)

VESPA GERMANICA, F.

♂ 1. Constantine, 12, xi. 94.
♀ 1. Mustapha Supérieur, 25, ii, 93.
☿ 1. Colonne Voirol, 4, v, 93.
☿ 1. Médéa, 1, vii, 93.

This is the only species of *Vespa* sent home.

XXIV. *On the Ichneumonidous Group* Tryphonides schizodonti, Holmgr., *with Descriptions of New Species.*

By Claude Morley, F.E.S.

[Read December 6th, 1905.]

These injurious parasites have upon several occasions come before the notice of our Society. Thomas Desvignes published (Trans. Ent. Soc., 1862, pp. 215–222) descriptions of ten supposedly new species of the genus *Bassus*, unfortunately with no knowledge that Holmgren had previously brought out (Sv. Ak. Handl., 1855, pp. 353–371) an elaborate revision of the group, wherein all such species, indicated by the former, as had been unknown to Gravenhorst (Ichn. Europ., 1829, pp. 310–357) are fully dealt with. Desvignes' names have ever since remained unsynonymized, a mere encumbrance to catalogues, and it is only now that they are for the first time relegated to their true positions. Bridgman also described five supposititiously new species in our Transactions (1882, p. 161; 1883, p. 170; 1886, pp. 364–5; 1887, p. 375), of which there are still three considered to be good. No reliable mention of British representatives of this group was made till the publication in 1856 of Desvignes' "Catalogue of British Ichneumonidæ," wherein are recorded eighteen Gravenhorstian and one new species. Of these, *B. rufipes* is no more than a variety of *B. biguttatus*, and *B. insignis* of *B. exultans*; the same author's paper of 1862 added four species under preoccupied names, leaving the total at twenty-one kinds. In 1870 the Rev. T. A. Marshall's "Ichneumonidum Britannicorum Catalogus" enumerated thirty-nine species, of which thirteen are now regarded as synonyms. Kirchner's "Catalogus Hymenopterorum Europæ" of 1867 mentions sixty-two kinds, among which, however, at least twenty-four are synonyms and three of the Fabrician titles appertain to other groups. In 1872, the Entomological Society published "A Catalogue of British Hymenoptera," which has ever since, though now sadly obsolete, been the basis-list of entomophagous work in Britain. In it we find

Bassus rufiventris incorrectly placed in the genus *Polyblastus*, and Desvignes' names are still treated as valid; the number of species is placed at forty, though thirteen of these are now considered synonymous. To these I was enabled to compile nine additions, in the paper I had the honour of reading before you on March 6th, 1901, which brought the actual total to thirty-six indigenous species. The palæarctic fauna now includes little more than sixty species (a few of which I do not know), and of these I am herein able to add eight to our catalogue, and to describe four kinds which appear to be new.

Phthorimus anomalus, sp. n.

Head not narrowed posteriorly, entirely black and subglabrous with the strongly pilose maxillary palpi apically white; vertex posteriorly entire; frons nitidulous, shortly pilose, sparsely and obsoletely punctulate, centrally subcarinate with the scrobes large and glabrous; face strongly nitidulous; epistoma somewhat convex and distinctly discreted from the short, broad, apically strongly emarginate clypeus by a straight fossa which is laterally produced upwards to the orbits; cheeks much shorter than basal width of the stout and laterally margined mandibles. Antennæ short, not reaching beyond apex of thorax; black with the pedicellus pale above; flagellum possessing about nineteen joints, ferrugineous beneath with apices of the joints subnodulose and infuscate; apical joint conical and obtuse. Thorax strongly nitidulous, immaculate; mesonotum anteriorly subconvex, evenly and finely punctate, with distinct notauli; mesopleuræ sparsely and evenly punctate, basally impressed in the centre; metathorax very strongly and evenly punctate with the petiolar area subobsolete and spiracles circular; areola glabrous, parallel-sided and twice longer than broad, with lateral costæ distinct, but costulæ wanting; metapleuræ sparsely pilose. Scutellum black, hardly convex, nitidulous and obsoletely punctate; postscutellum very small. Abdomen longer than head and thorax, immaculate, very strongly and evenly punctate throughout, with only the apices of the segments glabrous, and broadest at the apex of the first; second segment with distinct thyridii; terebra exserted, as long as the abdomen, with spicula flavous and strongly acuminate apically, valvulæ black and very strongly setiferous-pilose throughout. Legs clear red with all the coxæ and basal joint of trochanters black, with all the apical tarsal joints infuscate; hind metatarsi, except apically, flavescent and four times longer than their con-

colorous calcaria; tarsi not longer than the tibiæ, of which the hind pair is very slightly intumescent before the flavescent base. Wings hyaline with the stigma luteous, tegulæ and base of costa pale flavous; areolet sessile, twice broader than long; nervellus opposite and intercepted distinctly below the centre.

Length, 6 mm. (Terebra, 4 mm.) ♀ only.

There can be no doubt that this anomalous species, from the conformation of the mandibles and spatulately compressed abdomen, belongs to this genus as set forth by Thomson (Opusc. Ent., xiv, 1474); and perhaps also to *Phthorima*, Först. (Verh. pr. Rheinl., 1868, p. 162), but the latter's diagnosis is too short and he presents no type. It is closely allied to *P. compressus*, Desv., but differs abundantly in the posteriorly broader head, distinct notauli, the metathoracic structure, abdominal puncturation, strongly exserted terebra and very much broader areolet.

The Rev. F. D. Morice took a single specimen at Longcross, on June 17th, 1904; the type is in my collection.

Promethus dodsi, sp. n.

Black; legs, scutellum, post-scutellum and centre of abdomen broadly, red; antennæ beneath, part of the face and of the mouth flavous; mesonotum closely and coarsely punctate, dull; antennæ as long as the body; clypeus bifoveolate.

Length, 6 mm. ♀.

This species is so closely allied to *P. scutellaris*, Bridg., as to require no detailed description. Therefrom it differs in its twice longer antennæ (which possess twenty-four, not twenty-two, joints), its bifoveate clypeus which is subdentately produced apically in the centre and distinctly impressed transversely before the base; in its dull and coriaceously punctate mesonotum, distinct and discally coalesced notauli, strongly transverse areola; in the broadly flavous facial orbits, entirely rufescent clypeus, apically black epistoma, the antennæ entirely flavidous beneath, darker scutellum and red post-scutellum, immaculate trochanters, testaceous stigma; and in having the abdomen and especially its basal segment stouter, with segments three, four, base of the fifth and apex of the second entirely clear red, the last-mentioned being striolate from its base nearly to its apex. In the dull and confluently punctate mesonotum it resembles *P. pulchellus*, from which the

entirely pale coxæ and scutellum, as also the clypeal structure, at once distinguish it.

Taken by Dr. Capron, probably in Surrey; the type is in my collection.

Uxori mihi hoc insectum dicatum volo.

Homoporus niger, sp. n.

Head as broad as thorax, closely and finely punctate, somewhat dull; black with face, mouth except apices of mandibles, frontal orbits and the cheeks shortly, stramineous; vertex narrow and not posteriorly emarginate; frons strongly canaliculate centrally and the epistoma subdeplanate; clypeus convex, apically margined, evenly rounded and hardly emarginate apically in the centre; cheeks as long as breadth of mandibles at their base. Antennæ slightly longer than head and thorax, filiform, black above, scape and pedicellus stramineous and flagellum ferrugineous beneath. Thorax stout, somewhat nitidulous, strongly and evenly but not confluently punctate; notauli anteriorly wanting, though traceable from the broad and hamate pale line before the wing to the subdeplanate disc of the mesonotum; dots beneath both pairs of wings as well as before the anterior pair pale, as also is the mesosternum anteriorly; metathorax scabriculous, with the lateral costæ, petiolar and subquadrate basal areæ entire. Scutellum strongly deplanate, black; deeply and evenly but not confluently punctate. Abdomen subparallel-sided, entirely black; the two basal segments coarsely and confluently punctate, with their ventral plica dull testaceous; the first basally bicarinate nearly to its centre and the second basally irregularly striolate; the third segment basally scabrous, apically (with the following) nitidulous, obsoletely punctate and pilose; sixth apically truncate and not compressed, the two last inconspicuous and hardly exserted. Legs clear fulvous; all the coxæ and trochanters clear stramineous with the hind coxæ basally black; hind tarsi not infuscate, with calcaria one-third the length of their basal joint. Wings normal, radix stramineous, stigma fulvous; areolet sessile with the outer nervure sub-obsolete; nervellus sub-opposite and intercepted below its centre.

Length, 5 mm. ♂ only.

This species is certainly allied to *H. brevicornis*, Thoms. (only known in the ♀ sex), and it is just possible that it may represent its male, though differing in the short petiolar carinæ, posteriorly entire vertex, entirely pale stigma, substriate second segment and the colour of the

legs. At first I had thought it possibly the unknown ♂ of *H. longipes*, Holmgr., to which the colour of the legs is more nearly referable, but the comparatively short antennæ, entirely black abdomen and fulvous hind tarsi seem to preclude such a situation. In its distinct metathoracic areæ, it appears related with the *Aniarophron*-group, with which, however, it has no other character in common.

I swept this species from rank herbage in Wroxham Broad in the evening of June 14th, 1901; the type♀ is in my collection.

Homoporus reflexus, sp. n.

Head closely and confluently punctate, dull, black; vertex not broad, posteriorly entire; frons centrally distinctly, but not deeply, canaliculate; face coriaceously punctate somewhat broader apically, with the epistoma a little convex and quadrately pale in the centre; clypeus testaceous, deplanate, not laterally elevated, but with the apical margin entire and strongly reflexed; palpi and base of the stout mandibles flavescent, latter slightly broader than the length of the cheeks. Antennæ longer than head and thorax, and slightly pilose, filiform, entirely black with the apices of the seven basal flagellar joints subnodulose. Thorax black, with a hamate line and a dot before with a longitudinal callosity beneath the front wings, and the basal margin of the mesopleuræ flavous; mesothorax somewhat nitidulous, finely and evenly punctate throughout with the notauli entirely wanting; metathorax evenly scabriculous throughout with minute circular spiracles, and the apex centrally substrigose between two broad and shallow foveæ. Scutellum subdeplanate, evenly and closely punctate, somewhat nitidulous, with the apical margin, together with that of the post-scutellum, transversely flavidous. Abdomen elongate-oval, immaculate, centrally as broad as thorax, finely alutaceous and dull, becoming nitidulous towards the slightly compressed anus; basal segment quadrate, laterally marginate with no carinæ, the following transverse with the second obsoletely aciculate at its base; terebra reflexed. Legs clear red, with the tibiæ and front tarsi testaceous; the hind tibiæ becoming gradually nigrescent from centre to apex, and their tarsi entirely and the anterior at the apex, black; hind calcaria testaceous and not reaching centre of the metatarsus. Wings hyaline, with tegulæ white, stigma testaceous; areolet subpetiolate, broad with the outer nervure well defined; nervellus a little postfurcal and intercepted only slightly below the centre.

Length, 6½ mm. ♀ only.

From all the other members of the genus bearing an areolet and no petiolar carinæ, the present is very distinct in its apically entire and strongly reflexed clypeus. The alutaceous abdomen, thoracic coloration and general conformation ally it with *H. crassicrus*, Thoms., from which it is sufficiently distinct in its clypeal and vertical structure, canaliculate frons, apically explanate face, the antennæ entirely and scutellum laterally immaculate, the interception of the nervellus, acutely margined basal segment, the dull testaceous hind tibiæ and abdominal plica.

The type, which is in my collection, was taken by Dr. Capron probably in Surrey; I also took this species in a greenhouse at Ryde in the Isle of Wight in August 1902.

Homoporus incisus, Thoms., ♂.

Its author only knew the female of this species; the male differs in nothing but size and coloration. Epistoma, clypeus and mouth excepting apices of mandibles, stramineous, orbits and cheeks immaculate: a broad subhamate line before and a callosity beneath the front-wings, with the basal margin of the mesopleuræ stramineous; apices of scutellum and of post-scutellum, with the sides of the former somewhat broadly flavous; legs pale red with all the coxæ and trochanters, and the hind tibiæ (except at their extreme base and apex), whitish; abdomen subparallel-sided, broadest behind the centre.

Length, 5½ mm.

A Synopsis of the Palæarctic Bassides.

(2).	1. Metathoracic spiracles large and pale; scutellar fovea costate.	Trichomastix.
(1).	2. Metathoracic spiracles small and immaculate; scutellar fovea simple.	
(8).	3. Face dull and punctate, not distinctly impressed longitudinally.	
(5).	4. Notauli deeply impressed; scape excised to its centre . . .	Zootrephus.
(4).	5. Notauli obsolete; scape not deeply excised.	

(7). 6. Anterior segments transversely impressed ; tibiæ white . . Bassus.
(6). 7. Anterior segments not impressed or tibiæ not white . . . . Homoporus.
(3). 8. Face shining and subglabrous, bicarinate longitudinally.
(10). 9. Areolet wanting ; abdomen not entirely black. . . . . Promethus.
(9). 10. Areolet present ; abdomen black and spatulately compressed . Phthorimus.

Trichomastix, Voll.

A large black, shining species, with legs red ; scutellum laterally white . . . . . 1. *flavipes*, Holmgr.

Zootrephus, Thoms.

(2). 1. Flagellum 18-jointed ; anus broadly black ; metathorax more rugose . . . . . 1. *rufiventris*, Grav.
(1). 2. Flagellum 22-jointed ; anus narrowly black ; metathorax less rugose . . . . . 2. *holmgreni*, Bridg.

Bassus, Fab.

(6). 1. Anterior coxæ not entirely pale ; abdomen rarely red-marked.
(3). 2. Hind coxæ red ; basal segment apically pure white . . . . 1. *albosignatus*, Grav.
(2). 3. All the coxæ black ; basal segment not white-marked.
(5). 4. Apex of hind tibiæ black ; ♀ epistoma white-marked . . 2. *varicoxa*, Thoms.
(4). 5. Apex of hind tibiæ ferruginous ; ♀ epistoma immaculate 3. *annulatus*, Grav.
(1). 6. Anterior coxæ entirely pale ; abdomen usually centrally red.
(10). 7. All the coxæ pale.
(9). 8. Abdomen not broadly red centrally ; hind tibiæ bicolored . 4. *tricinctus*, Grav.
(8). 9. Abdomen broadly red centrally; hind tibiæ tricolored . . . 5. *lætatorius*, Fab.
(7). 10. Hind coxæ basally black ; central segments red-banded . . 6. *multicolor*, Grav.

HOMOPORUS, Thoms.

(30).	1. Areolet wanting (?SYRPHOCTONUS, Först.).	
(19).	2. Metathoracic areæ not entirely wanting.	
(14).	3. Second segment transverse; anus often somewhat dull.	
(11).	4. Basal area distinct and entire; hind tibiæ not white.	
(8).	5. Notauli wanting; scutellum pale.	
(7).	6. Femora entirely, abdomen not broadly, red	1. *cinctus*, Grav.
(6).	7. Femora basally black; abdomen usually broadly red	2. *bizonarius*, Grav.
(5).	8. Notauli distinct; scutellum black.	
(10).	9. Hind femora black; orbits alone pale	3. *graculus*, Grav.
(9).	10. Hind femora red; face immaculate	4. *brevitarsis*, Thoms.
(4).	11. Basal area obsolete; hind tibiæ white.	
(13).	12. Scutellum, and often the mesonotum and pleuræ, red . .	5. *pectoratorius*, Gr.
(12).	13. Scutellum centrally black, apex or also the sides flavous . .	6. *alpinus*, Holmgr.
(3).	14. Second segment quadrate; anus strongly nitidulous.	
(16).	15. Clypeus convex; antennæ shorter than expanded wings	7. *caudatus*, Thoms.
(15).	16. Clypeus deplanate; antennæ as long as expanded wings.	
(18).	17. Coxæ red; epistoma immaculate; second segment striolate	8. *longipes*, Holmgr.
(17).	18. Coxæ black; epistoma pale; second segment not striolate .	9. *punctiventris*, Th.
(2).	19. Metathoracic areæ entirely wanting.	
(21).	20. Scutellum subtumidous, immaculate	10. *borealis*, Holmgr.
(20).	21. Scutellum normal, nearly always pale.	

(29). 22. Vertex of head more or less emarginate.
(28). 23. Scutellum only partly pale; hind tibiæ usually black with base white.
(27). 24. Meso-humeral marks, and usually the epistomal, wanting.
(26). 25. Metathorax not apically red . 11. *biguttatus*, Grav.
(25). 26. Metathorax apically red . . . 12. *abdominator*, Bridg.
(24). 27. Meso-humeral marks, and the epistoma always pale . . . 13. *flavolineatus*, Gr
(23). 28. Scutellum entirely pale; hind tibiæ red with apex black . 14. *tarsatorius*, Panz.
(22). 29. Vertex of head not emarginate; scutellum laterally pale . . 15. *fissorius*, Grav.
(1). 30. Areolet present or abdomen broadly fulvous.
(60). 31. Abdomen with no segment entirely red; hind tibiæ usually white.
(41). 32. Petiolar carinæ distinct and usually elongate; tibiæ not mainly white.
(36). 33. Hind tibiæ basally white.
(35). 34. Petiolar carinæ parallel . . . 16. *ornatus*, Grav.
(34). 35. Petiolar carinæ divergent (? ENIZEMUM, Först.) . . . 17. *deplanatus*, Grav.
(33). 36. Hind tibiæ not white-marked.
(40). 37. Clypeus not apically excised; scutellum black; areolet weak.
(39). 38. Anterior coxæ and hind tarsi black . . . . . 18. *brevicornis*, Thoms.
(38). 39. Anterior coxæ and hind tarsi pale . . . . . 19. *niger*, Morl.
(37). 40. Clypeus apically excised; scutellum pale; areolet strong . 20. *sundevalli*, Holmgr.
(32). 41. Petiolar carinæ short or wanting; hind tibiæ usually mainly white (? HOMOTROPUS, Först.)
(59). 42. Scutellum not entirely pale, nor the second segment strongly elongate.
(56). 43. Scutellum of normal size and convexity.

(45).	44.	Clypeus apically reflexed and entire	21. *reflexus*, Morl.
(44).	45.	Clypeus apically not reflexed nor entire.	
(47).	46.	Clypeus apically strongly excised and laterally elevated	22. *incisus*, Thoms.
(46).	47.	Clypeus apically emarginate and not laterally elevated.	
(53).	48.	Clypeus laterally foveate.	
(52).	49.	Hind tibiæ basally infuscate.	
(51).	50.	Scutellum apically white; ♀ flagellum red	23. *ruficornis*, Holmgr.
(50).	51.	Scutellum usually laterally white; ♀ flagellum black .	24. *pumilus*, Holmgr.
(49).	52.	Hind tibiæ often externally, though hardly basally, infuscate	25. *dimidiatus*, Schr.
(48).	53.	Clypeus not laterally foveate.	
(55).	54.	Hind tibiæ normal and basally infuscate	26. *longiventris*, Thoms.
(54).	55.	Hind tibiæ stout and not basally infuscate	27. *crassicrus*, Thoms.
(43).	56.	Scutellum large and somewhat strongly convex.	
(58).	57.	Metathorax rugulose; second segment longitudinally strigose	28. *strigator*, Fab.
(57).	58.	Metathorax finely punctate; second segment not strigose .	29. *megaspis*, Thoms.
(42).	59.	Scutellum entirely pale; second segment strongly elongate .	30. *xanthaspis*, Thoms.
(31).	60.	Abdomen nearly always broadly red centrally; tibiæ not white.	
(66).	61.	Scutellum not entirely black or basal segments scabrous.	
(63).	62.	Scutellum at most apically pale; second segment punctate . .	31. *elegans*, Grav.
(62).	63.	Scutellum mainly pale; second segment subglabrous.	
(65).	64.	Areolet present; second segment elongate	32. *pallidipes*, Grav.
(64).	65.	Areolet wanting; second segment transverse	33. *pulcher*, Holmgr.

(61). 66. Scutellum entirely black; basal segments not scabrous (? ANIAROPHRON, Först.)

(68). 67. All the coxæ pale; areolet present . . . . . 34. *signatus*, Grav.

(67). 68. Hind coxæ basally black; areolet wanting . . . . . 35. *hygrobius*, Thoms.

PROMETHUS, Thoms.

(12). 1. All the coxæ pale; petiolar area not coarsely sculptured.

(7). 2. Scutellum pale.

(6). 3. Abdomen broadly red centrally.

(5). 4. Mesonotum dull; second segment mainly striolate . . . 1. *dodsi*, Morl.

(4). 5. Mesonotum shining; second segment basally striolate . . 2. *scutellaris*, Bridg.

(3). 6. Abdomen nearly entirely black 3. *nigriventris*, Thoms.

(2). 7. Scutellum black.

(11). 8. Notauli present; coxæ flavous.

(10). 9. Abdomen nearly entirely black 4. *melanaspis*, Thoms.

(9). 10. Abdomen broadly red in the centre . . . . . 5. *sulcator*, Grav.

(8). 11. Notauli wanting; coxæ white 6. *albicoxa*, Thoms.

(1). 12. Hind coxæ mainly black; petiolar area finely sculptured.

(14). 13. Basal segment twice longer than broad; coxæ white . . . 7. *cognatus*, Holmgr.

(13). 14. Basal segment not elongate; coxæ flavescent.

(16). 15. Third segment with a basal fascia or lateral gutta citrinous . . . . . 8. *laticarpus*, Thoms.

(15). 16. Third segment with no citrinous markings.

(18). 17. Mesonotum dull and confluently punctate . . . . . 9. *pulchellus*, Holmgr.

(17). 18. Mesonotum shining and sparsely punctate.

(20). 19. Stout; second segment apically glabrous . . . . . 10. *festivus*, Fab.

(19). 20. Slender; second segment entirely scabrous . . . . . 11. *dorsalis*, Holmgr.

PHTHORIMUS, Thoms.

(2).	1. Areola transverse; temples narrow; abdomen not strongly punctate	1. *compressus*, Desv.
(1).	2. Areola elongate; temples broad; abdomen strongly punctate .	2. *anomalus*, Morl.

SYNONYMY, ECONOMY AND DISTRIBUTION.

During the course of the last ten years I have been enabled to amass a little over seven hundred specimens of this group in Britain, and perhaps it may not be out of place to here indicate their relative frequency in our islands. The species bearing an asterisk have not yet been noted as indigenous; of the rest there are only three species not represented in my collection, from the closely examined specimens of which alone this summary is drawn up, the respective number of specimens there representing each species is indicated in parentheses. A dagger indicates that the species is new to Britain.

T. flavipes, Holmgr. (1.) Very rare; my only specimen was taken by Dr. Capron, probably about Shere in Surrey; Bridgman records it from Worcester in May, and doubtfully from Norfolk. It has been bred from a *Syrphus* pupa. [=*T. polita*, Voll.; =*B. tibialis*, Bridg.; =*T. pallipes* (*sic*), Thoms.]

Z. rufiventris, Grav. (7.) Not rare at Brandon in Suffolk in June 1903; Lowestoft on umbelliferous flowers, August; Wicken in Cambs., June; Reigate in July. [=*sulcator*, var. 2, Grav., ♂.]

Z. holmgreni, Bridg. (16.) Somewhat common in the Breck district of Suffolk, June to August; Surrey (*Capron*); Greenings (*W. Saunders*); Harting in May (*Beaumont*); Point of Aire (*Tomlin*). [I have followed Thomson in considering the species of *Zootrephus* as distinct; it is quite possible that Bridgman did not know *Z. rufiventris*, which stood under an incorrect genus in the British list. The relative rugosity of the metathorax and rufescence of the abdomen are the only features of separation which to me appear to be at all constant. Thomson separates them thus:—

HOLMGRENI, ♀.	RUFIVENTRIS, ♀.
Flagellum ferrugineous, 22-jointed	infuscate above, 18-jointed.
Metathorax more rugose	less rugose.
Basal segment	longer.
rugose with carinæ distinct	less rugose with shorter carinæ.
2*nd segment* fulvous or (var. b) basally black with thyridii obsolete	black with red line thyridii large and subcircular.
2*nd to* 4*th* with epipleuræ inflexed	2*nd and* 3*rd* with epipleuræ inflexed.
3*rd and* 4*th* always red	red, discally black-marked.
Hind legs elongate	less elongate.
femora red	red with black dot beneath.
trochanters citrinous	stramineous, basally black.
coxæ basally black	black to beyond their centre.
Intermediate coxæ citrinous	basally black.]

B. albosignatus, Grav. (4.) Certainly rare, occurring only in July; Cadney, Lincs. (*Peacock*); Nairn (*Verbury*); Southwold on flowers of *Heracleum sphondylium*; Kessingland, Suffolk, flying on the beach. It has been bred from *Syrphus sp.* [= *albosignatus*, Grav., ♀ et var. 3, ♂; Holmgr., excl. var. 3.]

B. varicoxa. Thoms. (17.) Common, June to August; Suffolk, Cambs., Herts., Point of Aire. [=*albosignatus*, var. 3, Holmgr. = ? *albosignatus*, var. 1, Grav.]

B. annulatus, Grav. (9.) Not very common from middle of July to end of September; Suffolk, Surrey. [= ? *albosignatus*, var. 2, Grav. It differs from *B. varicoxa*, Thoms., in the less deeply impressed incisures, entirely (♀) and internally (♂) ferrugineous apices of hind tibiæ; smaller humeral and scutellar pale marks and immaculate ♀ epistoma. The latter is probably no more than a variety.]

B. tricinctus, Grav. (43.) Abundant, May to September; Isle of Mull (*Tomlin*); Yorks. (Askrigg, *Elliott*), Gloucester, Hereford, Herts., Suffolk, London, Surrey, Sussex, Hants., Devon. [= *albosignatus*, var. 4, ♂, Grav. = *nemoralis*, Holmgr. This species differs from *nemoralis* in nothing but the abdominal coloration; the latter is a var.]

B. lætatorius, Fab. (90.) Abundant, May to September; Norfolk, Suffolk, Essex, Lincs., Herts., Gloucester,

London, Kent, Surrey, Sussex, Isles of Wight and Purbeck, Cornwall (Cremyl, *Newbery*). Also from Bucarest. It is said to have been bred from such varied hosts as *Adimonia rustica*, *Tortrices*, *Syrphus balteatus* and *S. pinastri* (= ? *corollæ*);—*cf.* also Entom., 1884, p. 167.

B. multicolor, Grav. (13.) Very local but common where it occurs, in marshes, June; Horning Ferry in Norfolk and Tuddenham Fen in Suffolk; Sussex, Surrey. [= *delctus*, Thoms, ♂ ♀.]

H. cinctus, Grav. (18.) Uncommon in woods in May and June, also found in autumn; Lincs., Herts., Suffolk, Surrey. [= *lateralis*, Grav. = *albicinctus*, Desv., ♂; var. = *scabriculus*, Holmgr.]

H. bizonarius, Grav. (15.) By no means common, June to September; Herts., Norfolk, Suffolk, Essex; apparently commoner in Surrey. Also from Nantes. [= *cingulatus*, Holmgr. = ? *frontalis*, Brisch. This species greatly resembles *Bassus multicolor* superficially in its more or less distinct tranverse segmental impressions, entirely white scutellum and usually brightly cinctured central segments; the coloration of the hind tibiæ, however, readily distinguishes it from that genus. The outer recurrent nervure is rarely entirely wanting.]

H. graculus, Grav. (18.) Not uncommon in boggy spots in May, July and August; Suffolk, Herts., Gloucester, Surrey, Conwall. [*B. graculus*, Grav., ♀ = *obscuripes*, Holm., ♂ ♀ = *rufocinctus*, Desv., ♂ ♀.]

H. brevitarsis, Thoms.* Switzerland.

H. pectoratorius, Grav. (11.) Local in woods in May and August; Suffolk, Surrey, Isle of Wight.

H. alpinus, Holmgr. ♀ [= ? *monticola*, Voll., ♂.]* Scandinavia and ? Switzerland.

H. caudatus, Thoms.† (1.) The only specimen I have seen was taken by Capron in Surrey.

H. longipes, Holmgr.* Scandinavia.

H. punctiventris, Thoms.† (2). Felden near Boxmoor, in Herts. (*Piffard*); Cornworthy near Totnes, in Devon (*Marshall*).

H. borealis, Holmgr.* Lapland.

H. biguttatus, Grav. (9.) Probably not common; I only possess it from Surrey and Herts. [= var. *rufipes*, Grav., Holmgr. = var. (scut. apically white) *deplanatus*,

Grav. et Holmgr., excl. ♂ (= *biguttatus*, var. e, Thoms.) ; = *confusus*, Woldst. This is a most variable species and the sexes are dissimilar.]

H. abdominator, Bridg. The unique ♀ was taken by Bignell at Dousland (Devon.), August 23rd, 1884, and is in his collection. [This is probably no more than a colour variety of *H. biguttatus*, though considered valid by Thomson.]

H. tarsatorius, Panz. (52.) Abundant in woods and marshes in May and June, also occurs on flowers of *Angelica sylvestris* in the autumn ; Yorks. (Askrigg, *Elliott*), Lincs., Suffolk, Herts., Surrey, Sussex, Isle of Wight. Also from Bucarest. It is said to have been bred from *Syrphus balteatus, Depressaria angeliella* and *Coccinella sp.* [= *insignis* et *exultans*, Grav. et Holmgr. = *pulchellus*, Desv., ♂ (*nec* Holmgr.) = *flavus*, Desv., ♂ (var. c, alis areola completa, Thoms.). This is the only species I know which may or may not possess an areolet; when present it is very small, oblique, consisting of little more than the duplication of its basal nervure ; only one ♀ of my fifty specimens possesses it.]

H. flavolineatus, Grav. (11.) Not very common, June and August; Suffolk, Herts., Surrey, Devon. [= *interruptus*, Holmgr., ♂ = *bimaculatus*, Holmgr. ♂ ; *nec* Zett.]

H. fissorius, Grav. (9.) Uncommon and always occurs singly, May, July, and September; Kent (Huntingfield, *Morice*), Surrey, Hants., Suffolk, Herts., Gloucester. [= *punctatus*, Bridg. ; *nec fissorius*, Holmgr.]

H. ornatus, Grav. (7.) Very uncommon, May, August, and September; Suffolk (Lowestoft and Southwold), London (Blackheath and Plumstead, *Beaumont*), Hants. (Lyndhurst, *Adams*), Isle of Wight (Ryde). It has been bred from *Syrphus sp.* [= *frenator*, Desv., ♂ . = *ornatus*, Thoms., ♂ ♀. = var. ♀ ; *deplanatus*, Holmgr., "♂."]

H. deplanatus, Grav. (3.) In Dr. Capron's collection from Surrey. It has been bred from *Syrphus sp.* [*deplanatus*, Grav. et Holmgr., excl. ♂ = *nigricornis*, Thoms., ♂. Gravenhorst's ♂ differs from that of *B. ornatus* (with which it is incorrectly synonymized by Thomson) in its immaculate face, red antennæ, immaculate sternum, black-marked front coxæ, simply white-

circled hind tibiæ, the pale marking of which does not extend down the leg, etc.]

H. brevicornis, Thoms.* France.

H. niger, Morl.† (1.) Norfolk.

H. sundevalli, Holmgr. I have not seen this species; recorded from Devon. in September (*cf.* Trans. Devon. Ass., 1898, p. 501). [= *scabrosus*, Desv., ♂.]

H. reflexus, Morl.† (2.) Isle of Wight and Surrey.

H. incisus, Thoms.† (4.) Apparently rare; Surrey and the Isle of Wight, in August.

H. ruficornis, Holmgr. [= ? *suspiciosus*, Brisch.]* Sweden and ? Prussia.

H. pumilus, Holmgr. (15.) Common from June to September; Cheshire, Herts., Suffolk, London (Wimbledon and Blackheath), Surrey, Isle of Wight. [= *thoracicus*, Desv., ♀ = ? *pictus*, Grav. *part.* One ♂ I examined possessed a distinct areolet in the left wing but no trace of one in the right.]

H. dimidiatus, Schr. (45.) Abundant, May to September; Scotland (Crockston and Bonhill, *Dalglish*), Suffolk, Herts., Sussex, Surrey, Hants., Isle of Wight and Cornwall. [= *pictus*, Grav., Holmgr., Thoms. = *planus*, Desv., ♂ ♀ (♀ = var. b, Thoms.).]

H. longiventris, Thoms.† (1.) The only male I have seen was swept in a marsh at Brandon in Suffolk, July 4th, 1903. [= *pumilus*, Holmgr. *part.*]

H. crassicrus, Thoms.† (6.) Apparently not common, August and September; Suffolk, Sussex, Surrey. [= *fissorius*, Holmgr., *nec* Grav.]

H. strigator, Fab. (1.) The only specimen of this species I have seen was swept from herbage in Henstead marsh (Suffolk), August 28th, 1898. Said to have been bred from larvæ preying upon *Siphonophora absinthii*. [This ♂ is very like that of *H. tarsatorius* in facies, but—besides the distinct areolet and scutellar coloration—the second segment is longer, coarsely longitudinally strigose with the thyridii obsolete; metathorax rugulose and much narrower above the hind coxæ, with the petiolar area centrally striolate and bearing some traces of a basal area; head narrower behind the eyes, with the vertex much less emarginate; face more distinctly punctate with the epistoma more prominent and cheeks shorter; clypeus similarly excised centrally but

acuminately explanate at the sides; antennæ shorter and consisting of 21 (not 20, as in the latter) flagellar joints and the scutellum is more convex and coarsely punctate (*cf.* also Brischke, Schr. Nat. Ges. Danz., 1878, no. 6, p. 112). The areolet and sculpture will also distinguish it from *H. fissorius*. It appears to only differ from *H. megaspis*, Thoms., in the sculpture of the metathorax and second segment, and in the colour of the hind tibiæ.]

H. megaspis, Thoms.* Bavaria.

H. xanthaspis, Thoms.† (4.) Rare; three from Surrey in Capron's collection and one I swept in Tuddenham Fen (Suffolk), August 23rd, 1905.

H. elegans, Grav. (35.) Abundant; June to October; London (Blackheath), Norfolk, Suffolk, Herts., Kent, Sussex, Surrey, Isle of Wight, Devon. Also from Nantua and Nantes. It has been bred from *Bombyx quercus*, and *Gracilaria phasianipennella*. [= *elegans*, Grav., ♀ (♂ in error), Holmgr., Desv. = *rufonotatus*, Holmgr. = *nigritarsus*, Grav., Holmgr., = *picitans*, Desv., ♂♀ (♂ = var. f., Thoms.).]

H. pallidipes, Grav. I have not seen this species; recorded from Devon in August (*cf.* Trans. Devon. Ass., 1898, p. 501).

H. pulcher, Holmgr. (2.) Very rare; two from Surrey in Capron's collection.

H. signatus, Grav. (28.) Abundant, June to September; Lincs., Norfolk, Suffolk, Herts., Surrey, London, Hereford, Ireland (Rossbeigh in Kerry). It has been bred from *Syrphus sp.*

H. hygrobius, Thoms. (13.) Not uncommon, May to October; Surrey, Suffolk, Lincs., Scotland (Giffnock). Also from Nantes. [= *festivus*, Holmgr., *part*; *nec* Grav.]

P. dodsi, Morl.† (1.) Surrey.

P. scutellaris, Bridg. (4.) Certainly rare; all my specimens are from Surrey; Bridgman describes it from Devon. [*B. scutellaris*, Bridg., ♀ (*nec* ♂), Thoms., ♂ ♀.]

P. nigriventris, Thoms.* Sweden.

P. melanaspis, Thoms.* Bavaria.

P. sulcator, Grav. (78.) Abundant, May to October; Devon., Hants., Worcester, Herts., Suffolk, Norfolk, Cambs., Scotland (Crockston, *Dalglish*). It has been bred from *Syrphus sp.* [*sulcator*, Grav., excl. var. 2–5 et 1 ♂ = *areolatus*, Holmgr.]

P. albicoxa, Thoms.† (9.) Probably not uncommon, June to August; Stafford., Herts., Norfolk, Surrey, Isle of Wight. [= ? *sulcator*, var. 5, Grav., ♂.]

P. cognatus, Holmgr. (20.) Common, May to September; Suffolk, Norfolk, Herts., Surrey, Sussex, Cornwall (Botusfleming, *Marshall*).

P. laticarpus, Thoms.† (5.) Rare, in boggy situations; ♀♀ swept in Henstead marsh (Suffolk), 12, vii, 1900, and Rockland Broad (Norfolk), 10, vi, 1901; ♂♂ at Metton (Norfolk), 30, viii, 1903; and Greenings (Surrey) from W. Saunders' collection, viii, 1871. Also from Nantes. [= ? *gracilentus*, Holmgr.]

P. pulchellus, Holmgr. (54.) Very common May to October; Suffolk, Norfolk, Northants., Herts., Wilts., Wales (Trefriw, *Newbery*), Devon., Cornwall, Isle of Wight. [=*sulcator*, var. 1 ♂, 3 et 4, Grav. = *festivus*, var. 2 et 3, Grav. =*fraterculus*, Först.]

P. festivus, Fab. (20.) Uncommon, July only; Suffolk, Herts., Surrey, Kent. It has been bred from *Syrphus sp.*, and *Heliodines roesella* (*cf.* Isis, 1848, p. 986). [=*festivus*, Grav., ♂♀, excl. var., 2 et 3; Grav. var. 1, *facie tota nigra*, ♀.]

P. dorsalis, Holmgr. (9.) Not common, in marshy places, June and July; Suffolk, Surrey. [*B. dorsalis*, Holmgr. ♀ = *maculatus*, Desv. ♂♀.]

P. compressus, Desv. (1.) Very rare; I took a female at Felden in Herts., while staying with Mr. A. Piffard, flying on a chalky hillside, on August 9th, 1903—probably the only localized British specimen. I noticed that in life the abdomen was no less compressed. [=*Bassus ibalioides*, Kriech.]

P. anomalus, Morl.† (1.) Longcross.

I propose to conclude this paper with the description of four little-known species of Bassus (*sensu*, Grav.), which have been utterly ignored by all systematists:—

Bassus hispanicus, Spinola.

Ann. Soc. Fr., ser. ii, I (1843), p. 118.

Dull and strongly punctate, black. Face deplanate, clypeus apically truncate and not discreted. Antennæ filiform, black, 32-jointed, and as long as the body; scape obconical and deeply excised; flagellar joints cylindrical with the second and third obconical, very short and the fourth elongate. Metathorax with a

central transverse carina and the petiolar area basally rounded. Scutellum and post-scutellum subconvex, immaculate. Abdomen black with segments two to four red; the basal longer than broad and apically explanate; second and third uniformly convex, with no transverse impressions. Legs red with coxæ, base of the front trochanters and apices of their tarsi, black. Wings hyaline; nervures basally, and tegulæ, red.

Length, 9 mm.

Southern Spain (*Victor Ghiliani*).

Bassus athaliæperda, Curtis.

Farm Insects (1860), 53.

Black, minutely punctate and finely pubescent. Face and mouth white, with epistoma longitudinally, and the clypeal foveæ black; labrum and apices of mandibles dull ferrugineous. Antennæ as long as the body. Legs red and somewhat stout; coxæ flavous; tarsi and basal half of hind tibiæ fulvous, the latter apically and their tarsi black. Wings iridescent; costa and stigma fulvous, nervures piceous; areolet wanting.

Length, 6 mm.

England; bred from *Athalia spinarum*.

Bassus carinulatus, Ruthe.

Stett. Ent. Zeit. xx (1859), p. 373, ♂ ♀.

Black. Palpi infuscate; ♂ with face, mouth and apices of cheeks stramineous; ♀ with clypeus and mandibles ferrugineous. Antennæ of ♂ as long as the body, basally fulvous, with the scape clear stramineous, beneath; of ♀ shorter, with the flagellum subrufescent beneath. Thorax of ♀ immaculate, with mesosternum closely punctate; of ♂ with lines before and beneath the radix, and the mesopleuræ anteriorly flavous. Scutellum black. Abdomen immaculate, with the basal segment rugosely punctate, bearing two subparallel carinæ; the second rugosely striate; anus of ♀ closely and finely punctate, of ♂ sparsely punctate and nitidulous. Legs pale red, with the hind tarsi and tibiæ black, the latter basally more or less broadly white; front coxæ of ♀ black, of ♂ stramineous. Wings with tegulæ of ♂ flavous; areolet triangular, petiolate, entire.

Length, 5–6 mm.

The ♀ resembles *B. deplanatus*, but is much more slender; the ♂ is nearer *B. ornatus*.

Iceland (*Dr. Staudinger*).

Bassus peronatus, Marshall.

E. M. M., xii (1876), p. 194, ♀.

Shining, punctulate, black. Head transverse and broader than thorax; face deplanate and not centrally canaliculate. Antennæ as long as the body, infuscate, testaceous beneath. Thorax nitidulous; mesosternum fulvous; metathorax rugose with distinct areæ, areola elevated and acutely margined. Scutellum convex, testaceous with its centre and two elongate lateral marks infuscate. Abdomen shining, with all the segments narrowly white apically, and not transversely impressed; basal segment broad, depressed, and subcontracted in front, with carinæ extending a little beyond its centre. Legs fulvous, hind ones stout; hind femora infuscate with their tibiæ, except basally, and tarsi black. Wings with tegulæ white; areolet wanting; nervellus intercepted far below the centre.

Length, 6 mm.

This species is said to be closely related to *B. pectoratorius*, differing therefrom in its immaculate pleuræ and metathoracic costæ. I very strongly suspect, however, that it represents the unknown ♀ of *B. strigator*, Fab.

England; bred from *Nematus caddcrensis* (*cf.* E. M. M., xii, p. 127).

I have quite failed to discover where *Bassus pipizæ*, Gir., is described; it is mentioned as parasitic upon *Pipiza noctiluca* in one of that author's posthumous works (*cf.* Laboulbéne in Ann. Soc. Fr., 1877, p. 408). Dr. Giraud's memoirs are numerous, extending from 1854 to 1871 according to Mocsáry, but this species is not mentioned in the Annales from 1852 (when he joined the Society) to 1872, nor do I find it in the Zoological Record; it may appear in one of his contributions to the Verh. Wien. z. b. Ver., but it is more probably a MS. name (*cf.* Marshall, Bracon. d'Europ. i, 199).

January 3rd, 1906.

THE

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR 1905.

February 1st, 1905.

Mr. F. MERRIFIELD, President, in the chair.

Mr. MERRIFIELD, taking the chair as President, said it would be in accordance with some recent precedents if he expressed his acknowledgments for the honour which had been conferred on him. It was also a responsibility. He succeeded one under whose Presidency the Society, which had been steadily rising for years in numbers, in utility, and in scientific estimation, had reached the highest point yet attained. At the last meeting, when Professor Poulton vacated the office which he had filled with so much distinction, two past Presidents of the Society appropriately bore testimony to his services; it would not be inappropriate if he took the opportunity which this meeting afforded him of saying how cordially he concurred in all that was then said. The Presidency of one so widely known, and so appreciated in all parts of the world where biological research, united with powers of exposition, was valued, reflected honour on the Society with which he was thus associated. In the speaker's little research work he had had the kindest help from Professor Poulton, and he might add that also of the many other Fellows who had taken the leading part in the work of the Society. With their continued aid and support he hoped he might be able to perform the duty which was incumbent on every one who filled that

chair—to do all in his power to promote the interests of the Society and the advancement of science, and, as he intended to take some trouble towards these ends, he hoped he might attain some of the moderate success which usually attends on well-meant exertion.

Nomination of Vice-Presidents.

The President then announced that he had appointed Dr. Thomas Algernon Chapman, M.D., F.Z.S., Dr. Frederick Augustus Dixey, M.A., M.D., and Professor Edward B. Poulton, M.A., D.Sc., F.R.S., as Vice-Presidents for the Session 1905–6.

Exhibitions.

Mr. H. St. J. Donisthorpe exhibited specimens of *Oligota granaria* found in a granary in Holborn, the only other localities reported hitherto being Shoe Lane, London, and Scarborough.

Mr. W. J. Kaye exhibited a specimen of the Erycinid butterfly *Mesosemia eumene* pinned in its natural position of rest to show its resemblance to the head of a small mammal, such as a mouse. The eye-spots of both fore- and hind-wings came together in such a way as to resemble the two eyes of the animal, while the outline of the wings so closed constituted a family class-likeness to the sharp outline of the mouse's head.

Professor Poulton remarked that, as the eye-spot was placed close to the body near the base of the wings, the ordinary protective value thereof might be explained in some such way.

Dr. T. A. Chapman exhibited a variety of the female of *Lycæna melanops*. As a mere aberration it was interesting; but it was of value as showing that the position in the genus for long accorded to the species, whether by accident or design, close to the *arion—euphemus* group, was correct.

The considerable extension of the blue in this specimen showed up certain black spots on the upper surface of both upper and lower wings, strictly similar to these characteristics of the *arion—euphemus* group. He placed with it for illus-

tration specimens of *arion*, *euphemus*, *alcon* and *arcas*. Also a fairly typical ♀ *melanops* from Digne, and another from Spain, perhaps more usual in colour, viz. with very little blue, but of large size; also two other specimens from Digne, in which traces of the black spotting were easily seen, after the variety exhibited had shown what to look for. Dr. Chapman proposed to name the variety, which seemed to be undescribed,

Lycæna melanops, Boisd., var. *wheeleri*, Chapm.

(× 2)

var. *wheeleri*, in recognition of the work of the Rev. George Wheeler on Alpine Butterflies.

Mr. F. Enock exhibited a living ♀ *Hybernia defoliaria*, taken as late as February 1st, and another ♀ taken January 28th, both at rest on north side of an oak-tree, in the same wood at Bexley. He also exhibited on behalf of Mr. Leonard Newman, of Bexley, two fine hybrids bred from a ♂ *Notodonta ziczac*, and a ♀ *N. dromedarius*, the colour being that of *dromedarius*, while the markings were those of *ziczac*. He also showed two varieties of *N. ziczac* var. bred from larvæ

taken in Kent, which had the pebble marking much suffused, and the ground-colour darker than the types.

Mr. O. E. Janson exhibited a living specimen of *Acridium ægyptium*, L., found in a cauliflower in Bloomsbury, and probably imported from Italy. Professor Poulton said he had also received similar examples introduced in the same way.

Mr. G. C. Champion exhibited two examples of *Malachius barnevillei*, Puton, captured by Mr. Thouless at Hunstanton, Norfolk, in June 1899, a recent addition to the British List.

Mr. H. W. Andrews exhibited a ♂ and ♀ of *Machimus rusticus*, Mg., a rare Asilid, taken *in cop.* at Freshwater, Isle of Wight, on August 13th, 1903.

Mr. W. J. Lucas exhibited a ♀ *Panorpa cognata* taken at Byfleet Canal on August 23rd, 1904. The species occurs at Folkestone, and is said to be found in the New Forest. It is a little difficult at times to identify the ♀ alone, but Mr. K. J. Morton also had determined the insect in question to be *P. cognata*. For comparison he brought also ♀ specimens of *P. communis* and *P. germanica*.

Papers.

Mr. T. Gilbert Smith read a paper entitled "A revision of the genus *Criocephalus*, with notes on the habits of *Asemum striatum* and *Criocephalus ferus*," by himself and Dr. D. Sharp, M.A., F.R.S., and exhibited specimens to illustrate his remarks.

A discussion followed in which Mr. Donisthorpe remarked that he had bred *Criocephalus polonicus*, and Mr. A. J. Chitty, commenting on the life history of these beetles, said that he thought the longevity of some Coleopterous insects had hardly been appreciated. He possessed a *Dytiscus* still alive which he had taken in October 1902, while Mr. Donisthorpe mentioned the case of a Longicorn bred by Mr. C. O. Waterhouse which lived for twenty-one years. Commander Walker, Mr. G. C. Champion, and other Fellows continued the discussion.

Papers were also read by Dr. T. A. Chapman, M.D., F.Z.S., "On the Matrivorous Habit of *Heterogynis*," and "On the

Pupal Suspension of *Thais*," the author exhibiting a number of specimens of *Heterogynis* from Spain, and elsewhere.

Mr. E. Meyrick, B.A., communicated a paper on "Lepidoptera from New Zealand."

Mr. G. C. Champion, F.Z.S., contributed a paper entitled "Another Entomological Excursion to Spain (with description of two new species of Hemiptera by Dr. O. M. Reuter)," by Dr. T. A. Chapman and himself.

Wednesday, March 1st, 1905.

Mr. F. Merrifield (President) in the Chair.

Election of Fellows.

The Duke of Bedford, K.G., President of the Zoological Society, etc., of Woburn Abbey, Beds., and 15 Belgrave Square, S.W.; M. Lucien Chopard, Membre de la Société Entomologique de France, of 98 Boulevard St. Germain, Paris; Mr. Wilfrid Fleet, F.R.A.S., of "Imatra," Bournemouth; and Mr. Robert Sidney Mitford, C.B., of 35 Redcliffe Square, S.W., were elected Fellows of the Society.

Obituary.

The decease of M. Henri F. de Saussure, of Geneva, Honorary Fellow, of the Rev. Francis Augustus Walker, D.D., and of Mr. Alexander Fry, F.L.S., was announced.

Exhibitions.

Mr. H. St. J. Donisthorpe exhibited an example of *Oxypoda sericea*, Heer, taken in Dulwich Wood, June 17th, 1904, a species new to Britain; also *O. nigrina*, Wat., with a type lent by Mr. E. A. Waterhouse, to demonstrate that it is not synonymous with *sericea* as stated on the Continent; and *O. exigua*, which is also regarded there as synonymous with *nigrina*.

Mr. Hugh Main and Mr. Albert Harrison exhibited a long series of *Colias edusa*, with var. *helice* (bred from one ♀ *helice* sent by Dr. T. A. Chapman from the South of France), to show the proportion of type and variety obtained. The percentage worked out as follows:—

Total specimens: ♂ ♂ = 79	. . .	53%	
type: ♀ ♀ = 19	71	13%	47%
var.: ♀ ♀ = 52		34%	
150		100	
Of the ♀ ♀ type, = 19	. . .	27%	
variety, = 52	. . .	73%	
71		100	

They also showed the results of similar experiments with *Amphidasys betularia*, bred from a ♂ var. *doubledayaria*, and a type ♀ taken *in cop.* at Woodford, Essex, in 1903, as follows:—

	Type.	*Var.*		*Type.*	*Var.*
♂ ♂	22	21	=	21%	20%
♀ ♀	35	26	=	34%	25%
	57	47		55	45

Of the 43 ♂ ♂ 22 = 51% = type, following the ♀ parent.
21 = 49% = var. „ ♂ „
Of the 61 ♀ ♀ 35 = 57% = type, following the ♀ parent.
26 = 43% = var. „ ♂ „

As the result of "assembling" at Woodford, in June 1904, it was found that: 17 = ♂ type = 63%
10 = var. *doubledayaria* = 37%
27 100

Mr. R. A. R. Priske exhibited a specimen of *Helops striatus*, with a photograph, showing an abnormal formation of the

right antenna, which was divided into two branches from the fifth joint.

Mr. Percy H. Grimshaw showed examples of *Hydrotæa pilipes*, Stein, ♂ and ♀, the latter sex being previously unknown. The species was first recorded as British by the exhibitor in July 1904, the first specimens having been taken at Aberfoyle by Mr. A. E. J. Carter in July 1903. Since that date it has also been discovered by Col. J. W. Yerbury at Porthcawl. Mr. Grimshaw also exhibited several specimens of *Hydrotæa tuberculata*, Rond, not hitherto recorded as British, captured by Mr. C. W. Dale and Dr. J. H. Wood in various localities.

Dr. F. A. Dixey exhibited some cocoons and perfect insects of hybrid *Saturnias*, and made the following observations:—

"I ventured some time ago (see Proc. Ent. Soc. Lond., 1897, pp. l–liii) to draw attention to the experiments in hybridisation made by Dr. Standfuss, of Zürich, and to lay before the Entomological Society a brief summary of his principal results. In the year 1898 I published in 'Science Progress' a more extended account of Standfuss's work in this direction, giving particulars of several of the hybrid forms obtained by him, and adding comments of my own on what appeared to be their biological significance. This paper is included in vol. ii of the 'Hope Reports' (1901), and portions of it may be found, though (doubtless from inadvertence) without due acknowledgment, in the pages of an important work on Lepidoptera, now in course of publication. An excellent translation, by Mr. E. M. Dadd, of Dr. Standfuss's account of some later results than those recorded in his 'Handbuch' (Jena, 1896), was also published in the 'Entomologist' for 1900 and 1901. It is illustrated by four well-executed photographic plates.

"Dr. Standfuss has been good enough at various times to present me with some of his specimens; these are now, with two exceptions, in the Hope Collection at Oxford.

"The examples I exhibit to-night consist of hybrids of two kinds. The first is a pair, male and female, of the hybrid between *Saturnia pavonia*, Linn., ♂, and *S. pyri*, Schiff, ♀ (see 'Science Progress,' 1898, pp. 188, 189; pp. 4, 5 of the paper as included in the 'Hope Reports,' vol. ii, 1901). I have

added specimens of both sexes of the parent forms for comparison, and it will be seen that the cross-product (which Standfuss calls *S. emiliæ*) resembles a large *S. pavonia* rather than a small *S. pyri*; except that the sexual disparity in size and colour, which is so marked in *S. pavonia* as compared with *S. pyri*, is very little developed in the hybrid. In most of Standfuss's specimens of this hybrid, some of the veins are forked terminally. This it will be seen is the case with one vein of the right fore-wing in the male exhibited.

"The second form is a hybrid with a somewhat more complex ancestry. It consists of three males and three females of which the female parent is *S. pavonia*, and the male parent a hybrid between *S. pavonia*, ♂, and *S. spini*, Schiff, ♀, *i. e.* the cross-product to which Standfuss has given the name *S. bornemanni*. The present form (called by Standfuss *S. schaufussi*) is therefore, in the common way of reckoning, three-quarters *S. pavonia* and one-quarter *S. spini*. Dr. Standfuss's first attempt to rear it ended in failure, his specimens all dying in the larval stage. Subsequent trials, however, were more fortunate, and some examples of Standfuss's own rearing are figured in the 'Entomologist' for 1900, Pl. VII, figs. 6, 7, 8. The six individuals I now exhibit were reared from eggs kindly sent me by Dr. Standfuss in 1895, and are some of the actual specimens mentioned in the footnote on p. 189 (p. 5 in the 'Hope Reports') of the paper above referred to.

"Their history is briefly as follows :—

1895.

May 11. Eggs received from Dr. Standfuss.

,, 23. Eggs nearly all hatched. Larvæ black, hairy. Fed on whitethorn. Show distinctly gregarious habit.

June 3. Larvæ undergoing first moult. Some in second stage show a rather indistinct yellowish-brown lateral line. They are still gregarious.

,, 14. Larvæ in second moult. In third stage still black, but some have a yellow or orange lateral line.

June 24. Third moult. Larvæ in fourth stage are still black; hairs whitish. Front of head pale green; some show small portions of green colour on body.

,, 29. Eighteen larvæ in fourth stage given to Professor Poulton, for the Hope Department. Five others were afterwards given to another friend. The subsequent history refers only to six specimens finally retained by me.

July 5. Fourth moult. In fifth stage the ground-colour is generally black; a variable amount of green may be present in addition; in two out of the six the green predominates. Tubercles yellow, deepening to orange.

,, 20. First larva began to spin cocoon.

,, 21. Three larvæ now spinning. The cocoons are those marked 1969 in the exhibit. These three larvæ are black with orange tubercles, one is mottled with a little dull green. All the larvæ have throughout been variable, but especially so in the last stage, varying from bright green with black rings (like *S. pavonia*) to uniform black. Tubercles orange in all.

,, 24. A bright green larva with definite black rings, began to spin. This cocoon is the one marked 1443.

,, 27. Another larva, resembling the last, now spinning (cocoon numbered 1327). The last larva retained by me, a specimen with much less green ground-colour than the two just noted, also spinning to-day (cocoon 1273 in the exhibit).

"These larvæ all had a profuse diarrhœal discharge before spinning; the discharge was clear and colourless when emitted, afterwards becoming brown. A period of quiescence, lasting for twenty-four hours or thereabouts, intervened between the discharge and spinning. During this period the larvæ seemed shrunken and looked torpid and unhealthy. The cocoons were spun among twigs of the food-plant (whitethorn) with few or no leaves, in a glass cylinder resting on a white glazed plate.

They were all brown in colour, two (Nos. 1230 and 1327) being a little paler than the rest.

"The first emergence took place on March 17, 1896. It is the female numbered 1327 in the exhibit, and resulted from the bright green *pavonia*-like larva which spun on July 27, making a rather light-brown cocoon. Only one more of my six specimens reached the perfect state, and this did not appear until Dec. 1, 1896. It came from the bright green larva which spun a dark reddish-brown cocoon on July 24, 1895, and is the male numbered 1443. The other four specimens having shown no sign of emergence, I opened and examined the cocoons in April, 1898. Three of them (numbered 1969), all dark brown, each contained a dead larva. The fourth (the last one to be spun) was a somewhat pale-brown cocoon of a curious shape, having two orifices for emergence, only one of which was furnished with converging bristles (No. 1273). It contained the cast larval skin and a dead pupa.

"The four remaining examples of this hybrid now shown belong to that portion of the original batch which was consigned on June 29 to the Hope Department. They were reared with the rest, as I have related, up to the fourth larval stage. I have no record of the time of their emergence.

"It will be seen that in this form (*S. schaufussi*) there is far less difference between the sexes than in *S. pavonia*. In spite of the fact that only one grandparent is *S. spini*, the influence of this latter species is seen both in the reduction of the sexual disparity and also in the prevailing aspect of the larvæ in their last stage. The difference between the male (No. 1443) and those which emerged in the Hope Department is very noticeable. A similar variability in the males of the same hybrid was observed by Standfuss ('Entomologist,' 1900, p. 346, note; and Pl. VII, figs. 6, 7). I attribute the semitransparency of most of the specimens to the want of vigour characterising the batch generally, and showing itself in another way by the number of larvæ that failed to attain the perfect condition.

"While on the subject of *Saturnia* I may perhaps be allowed to mention that a passage in Mr. Tutt's very complete account

of the larva of *S. pavonia* ('British Lepidoptera,' vol. iii, pp. 325, 326) may give rise unintentionally to a false impression. The eighty larvæ there spoken of as having been received from Norfolk were reared by myself, and not, as might appear from Mr. Tutt's account, by Professor Poulton, who indeed to the best of my belief never saw them. I must therefore assume the entire responsibility for the description of their markings which Mr. Tutt quotes. In the succeeding year I raised a fresh brood, numbering 120, from two of the pink-tubercled larvæ of 1885, the parent imagines being still in my possession; 40 of these 1886 larvæ were reared and described by myself, and 80 were given by me to Professor Poulton, who also duly noted their appearance in the last stage, as recorded by Mr. Tutt. My original account will be found in Trans. Ent. Soc. Lond., 1887, pp. 310, 311, having been kindly incorporated by Professor Poulton, at my own request, with his 'Notes in 1886 upon Lepidopterous Larvæ.' On reference to this account it will be seen that Professor Poulton fully acknowledges the source of the description."

The PRESIDENT exhibited some *Pyrameis atalanta*, some of them lent by Mr. R. S. Mitford, bred from pupæ found by Mr. Harwood, Colchester, which emerged on the last half of November and the first week of December last. Others in large numbers which had emerged earlier presented no remarkable features, but many of the later ones presented considerable differences, especially the following:—On the upper surface a patch or streak of blue or grey-blue scales on the fore-wings above the scarlet band and just below the large white spot on the costa; also a narrowing and partial interruption of the scarlet band by the invasion of black scales; on the under-side of the hind-wings a considerable increase of variegation, with an increase of the light areas, especially towards the outer margin. These effects are no doubt owing to the greater cold to which the pupæ were exposed than are the ordinary summer pupæ, as they resemble in their general nature the effects caused by artificially low temperatures; two specimens of which the President showed obtained by him ten years since; also, for comparison with these and Mr. Harwood's, a specimen at normal temperature, and a specimen bred at

80°–90° F., both also obtained ten years ago. Mr. Harwood kept no exact records of temperatures or dates, but states that most emerged in November, the last six in December; severe frost having set in early in November, when some just emerging died, apparently from this cause, and they were then brought into a fireless room; after a milder interval severe frost again set in, which caused them to be removed into a room with a fire. He remarks that probably all the very late larvæ and pupæ perish in this country under natural conditions; in which the President agreed with him—he never could get the pupæ to survive ten or eleven weeks of cooling, and believed that, as with *Pyrameis cardui*, the swarms of *atalanta* that decorate our gardens in the summer are all immigrants or their descendants; in the South of England there are certainly two broods in the year, perhaps more in hot summers. Mr. Harwood's experience was interesting, as it showed that there are natural variations of temperature which may produce effects on the facies of a butterfly corresponding with some of the results obtained by artificial temperatures ranging from that of an ordinary winter to that of a hot summer.

Commander J. J. Walker drew attention to the white spot on the scarlet band that most showed, which had been thought to indicate the female sex. The President said he thought all the specimens he had bred showed traces of the white spot on the under-side, so that he did not think it was an indication of sex; he had understood that the American examples were without the white spot.

Professor E. B. Poulton, F.R.S., exhibited (1) Groups of Synaposematic Hymenoptera and Diptera captured by Mr. A. H. Hamm, of the Hope Department, Oxford University Museum, and (2) Three specimens of *Papilio hesperus*, taken at Entebbe in 1903, by Mr. C. A. Wiggins. The attention of the exhibitor had to be called by Mr. W. Holland, of the Hope Department, to the fact that the tails of the hind-wing had not been broken off in these excessively worn and torn specimens. The evidence supports the conclusion that the tails of a *Papilio*, if untouched by enemies, can endure a great deal of wear. (3) Professor Poulton also showed Nymphaline

butterflies from Northern China, apparently mimetic of the male *Hypolimnas misippus*, which is not known to occur in this region.

A discussion followed, in which Sir George Hampson, Col. J. W. Yebrury, Mr. A. Bacot, and other Fellows joined.

Papers.

Sir George Hampson read for Mrs. De la B. Nicholl a paper on "Butterfly-hunting in British Columbia and Canada," illustrated by numerous examples of the species captured during the summer of 1904.

Sir George Hampson, B.A., F.Z.S., also communicated a paper "On three remarkable new Genera of Micro-lepidoptera."

Mr. Herbert Druce, F.L.S., F.Z.S., communicated a paper entitled "Descriptions of some new species of Diurnal Lepidoptera, collected by Mr. Harold Cookson in Northern Rhodesia in 1903–4: *Lycænidæ* and *Hesperiidæ*, by Hamilton H. Druce, F.Z.S."

Mr. F. Du Cane Godman, F.R.S., D.C.L., communicated a paper entitled "Descriptions of some new species of *Satyridæ* from South America."

Mr. W. L. Distant communicated a paper entitled, "Additions to a knowledge of the Homopterous family of *Cicadidæ*."

Wednesday, March 15th, 1905.

Mr. F. Merrifield (President) in the Chair.

Election of an Honorary Fellow.

Señor Don Ignacio Bolivar, of Paseo de Recoletos Bajo, 20, and Calle Jorge Juan, 17, Madrid, was elected an Honorary Fellow of the Society, in the place of Professor F. M. Brauer, deceased.

Election of Fellows.

Mr. Frank P. Dodd, of Kuranda, *vid* Cairns, Queensland; Mr. Cecil Floersheim, of 16 Kensington Court Mansions,

S.W.; Mr. Joseph Lane Hancock, of 3757 Indiana Avenue, Chicago; and Mr. Herbert C. Robinson, Curator of the State Museum, Kuala Lumpur, Selangor, were elected Fellows of the Society.

Mr. C. O. Waterhouse announced that the late Mr. Alexander Fry, a Fellow of the Society, had bequeathed his large and important collections of Coleoptera to the British Museum.

Exhibitions.

Dr. F. A. Dixey exhibited some butterflies from Natal which had been presented by Mr. G. A. K. Marshall, F.E.S., to the Hope Department at Oxford, and read the following note:—

"It will be remembered that some few years ago Mr. Marshall conducted certain experiments with a view to ascertain whether the assumption of the wet- or dry-season form of various African butterflies could be controlled by exposure in the pupal state to artificial conditions of temperature and moisture. Some of the results of these experiments were recorded and discussed by Mr. Marshall in Ann. Mag. Nat. Hist., 1901, vol. ii, p. 398. Others were dealt with in a paper published in Trans. Ent. Soc. Lond., 1902, p. 189. Most of the material produced in the course of this research was exhibited on the occasion when the last-named paper was read; the present specimens, however, though duly recorded in that paper, had not then reached the Hope Department. They were therefore not included in the comments added by me to Mr. Marshall's account of his experiments, and they have not previously been seen by the members of this Society. This note and exhibit may accordingly be taken as a kind of appendix to the paper in the 1902 volume of our Transactions.

"The specimens now shown are as follows:—

"(1) Four specimens of *Crenis boisduvalii*, Wallgrn.

"These form part of the series recorded by G. A. K. Marshall in Trans. Ent. Soc. Lond., 1902, p. 206. They consist of one ♂ reared under normal conditions; two ♀ ♀ exposed in the pupal condition to excessive moisture; and one ♀ similarly exposed to dry heat. They accord fairly with the seven specimens of the same series, reared under correspond-

ing conditions, which were presented by Mr. Marshall to the Hope Collection in 1897. The statements made (*loc. cit.*, p. 209) with regard to the original seven are confirmed by the new accessions, with the exception that the upper surface of the male kept in normal surroundings is perhaps somewhat lighter than that of the dry-heat male already in the Collection. The under surface, however, of this male, and the general aspect of all the females support the conclusion before arrived at that the intermediate or early dry-season form of this butterfly can be at least slightly influenced in the direction of the dry- or wet-season phase respectively by artificial conditions of dry heat and moisture.

"(2) Three specimens of *Pinacopteryx pigea*, Boisd.

"These three males are the specimens referred to by Mr. Marshall (*loc. cit.*, pp. 206–208) as *d* of the first series, and *g*, *k* of the second series. Like the previous examples resulting from the same experiment, which are nine in number and all females, they tend to show that under conditions of moisture a certain approach is made towards the wet-season form of this species; this, however, is less conspicuous in the present group of males than in the females just referred to.

"(3) A male specimen of *Teracolus annæ*, Wallgrn.

"This specimen is spoken of by Mr. Marshall (*loc. cit.*, p. 201) as the one example which emerged out of two that were kept as pupæ for nine days in a damp jar. The present specimen shows a nearer approach to the full wet-season form than the example in the Hope Collection which was left under moist conditions for seven days instead of nine. It is, however, less 'wet' than another male bred at nearly the same time under normal conditions (*loc. cit.*, p. 202). In the case of this species the numbers experimented with are probably too small to warrant a definite conclusion as to its susceptibility.

"(4) A male specimen of *Teracolus auxo*, Luc.

"This very interesting butterfly is the last of the three individuals mentioned by Mr. Marshall (*loc. cit.*, p. 201) as having been bred from eggs laid by *Teracolus topha*, Wallgrn. The example previously presented to the Hope Collection is quite of the *auxo* form, though not extreme; but the present specimen, as noted by Mr. Marshall (*loc. cit.*), shows a still

closer approach to the fullest *auxo* condition, which is known to be characteristic of the wet or summer season. The two specimens now referred to are of great value as having afforded the actual synepigonic proof of the specific identity of the two phases *T. auxo* and *T. topha*. This identity had been suspected so long ago as 1877 by Mansel Weale, who placed some of his specimens of these forms in the Hope Collection. But, as the writer has elsewhere stated, Mr. Marshall's experiments, the results of which are now at Oxford, remove the subject of the specific identity of these two forms from the region of probable conjecture to that of actual proof."

Mr. W. E. Sharp exhibited a specimen of the North American Longicorn, *Neoclytus erythrocephalus*, F. He said the species had been discovered in a sound ash-tree seven inches from the bark, grown in the neighbourhood of St. Helens, Lancashire. Some palings of American ash in the vicinity suggested the origin of the progenitors of the colony; but it was not known how long they had been erected. Mr. Sharp also showed examples of *Amara anthobia*, Villa, with a series of *A. familiaris*, Duf., and *A. lucida* for comparison. They had been sent him by the Rev. G. A. Crawshay from Leighton Buzzard, where they occurred not infrequently at the roots of grass in sandy places. Thinking their identity with *A. lucida* doubtful, he had sent them to M. Bedel, of Paris, who confirmed them as *A. anthobia*, Villa, a species not hitherto recorded in the British Lists.

Mr. M. Burr exhibited a number of mutilated *Stenobothrus* from the Picos de Europa, Spain. He said that these grasshoppers were taken at a height of about 1300 metres, on turfy ground exposed to north wind from the Atlantic, and covered with tufts of a short, dense, tough, and spiky shrub, together with heather. Of the grasshoppers occurring on this spot, almost every specimen had the wings and elytra more or less mutilated, sometimes actually torn to shreds, entirely altering their appearance. A notable exception was *St. bicolor*, of which no single specimen was found mutilated. This species also frequently indulged in flight, which the others were unable to do; and he suggested that its immunity might be due to the vitality which has enabled it to become the most abundant and

widespread grasshopper in Europe. Two ♀ ♀ of a species peculiar to the mountain, *St. cazurroi*, were also shown, one torn, one not torn. But of the common *St. viridulus* almost every specimen was mutilated.

Mr. F. W. Pierce exhibited drawings of the genitalia of Noctuid moths, and also with the lantern a number of slides showing the respective peculiarities of many members of the Genus. Among other things he drew attention to the fact that in the case of the *Tæniocampidæ* the genitalia were widely dissimilar, while his investigations had led him to conclude that *ashworthii*, at present ranked as an *Agrotis*, should more properly be included in the *Noctua* group.

Mr. L. B. Prout suggested that the arrangement was a physiological necessity for the separate existence of the various species of *Tæniocampa*, as they all observed practically the same habits and emerged simultaneously.

A discussion followed upon the value of the genitalia for the purpose of distinguishing species, in which Mr. G. C. Champion, Mr. A. W. Bacot, and other Fellows joined.

Wednesday, April 5th, 1905.

Mr. F. Merrifield, President, in the Chair.

Obituary.

The decease was announced of Dr. Alpheus S. Packard, an Honorary Fellow, and of Mr. Alfred Beaumont, and Mr. Alfred Preudhomme de Borre, Fellows of the Society.

Exhibits.

Mr. H. St. J. Donisthorpe exhibited a melanic specimen of a *Grammoptera*, discovered by Mr. C. J. C. Pool at Enfield, which appeared to be quite distinct from any member of the genus recorded in Britain, though Mr. E. A. Waterhouse had taken a similar example thirty years ago in Yorkshire. Mr. C. J. Gahan, to whom the specimens had been referred, considered them to be a form of *G. ruficornis*, F.

Mr. M. Jacoby brought for exhibition a specimen of *Megalopus melipona*, Bates, an insect which so much resembles a bee that Bates had said they were indistinguishable in nature. Professor E. B. Poulton remarked that the species recalled a little black *Trigona* from Borneo, recently discovered there by Mr. R. Shelford, but in this case the mimic was not of a stinging but of a biting model.

Mr. A. Bacot exhibited on behalf of Dr. Culpin specimens of *Papilio macleayanus* and *Hypocista metirius* captured in Queensland, illustrating the use of "directive" markings in the Rhopalocera in influencing their enemies to attack non-vital parts. All the specimens were taken on the same occasion, and the fresh condition of the *Papilio* was in marked contrast to the specimens of another species recently exhibited by Prof. Poulton, to show that the tails were not always the first portion of the wings to be lost.

It was noticeable that two out of the six specimens showed signs of an attack directed at the lobes of the hind-wings, situated at the base of the tails, and judging by the unset specimens, that these lobes were roughly suggestive of a head when the insect is at rest. In the other species eight out of the seventeen specimens showed damage at or near the small ocelli on the upper or under side of the hind-wings.

Mr. G. J. Arrow exhibited an example of *Ceratopterus stahli*, Westw., a beetle from Australia possessing notable powers of crepitation.

Mr. A. H. Jones and Mr. H. Rowland-Brown showed a series of *Erebia alecto* (*glacialis*), var. *nicholli*, Oberth., taken by them at about 8000 ft. at Campiglio, South Tyrol, with specimens of *Dasydia tenebraria*, var. *wockaria*, caught in the company of the *Erebias* in the same localities; when upon the wing the two species were not dissimilar. Mr. Jones also exhibited examples of *Erebia melas* from the Parnassus Mountains, Greece, for comparison, and fine forms of butterflies found at Mendel, near Botzen, including very large *Apatura iris* ♀ ♀, *Vanessa antiopa*, and *Satyrus semele*.

Mr. W. J. Kaye exhibited a ♀ *Morpho adonis* from British Guiana together with several males. The female sex is extremely rare, and was only definitely known in 1881,

when it was described and figured by Mr. W. L. Distant in the Transactions of the Society for that year. Mention was made as to how the vast difference in the sexes arose, and it was suggested as probable that originally both sexes were blue with a broad white band, as is the case with the allied *Morpho cypris* and *Morpho helena*. The ♂ had, however, now lost all trace of the white band, while the ♀ had retained the white band and suppressed all the blue scaling. In *Morpho cacica*, ♂, normally the white band was absent, but as a rare aberration a well-defined band was present, thus showing that this phase of development was frequent in the genus. Amongst the male specimens were two that had apparently been attacked by natural enemies. One showed a large beak-shaped rent in one of the fore-wings, indicating attack while the insect was sailing with outstretched wings. Another had a large piece removed from the anal angle of both hind-wings; the damage on both sides coinciding when the insect was sitting with folded wings.

Dr. F. A. Dixey exhibited the social web and pupal shells of *Eucheira socialis*, Westw., together with specimens of the perfect insect, and made the following observations:—

"By the kindness of Professor Poulton I am able to show the common larval habitation of the remarkable gregarious Pierine *Eucheira socialis*, Westw. This is the actual nest, from Mexico, which was described and figured by Westwood in Trans. Ent. Soc. Lond., 1836, p. 38, and Pl. VI, figs. 1 and 2. The longitudinal incision is the one originally made by the late Hope Professor; the two transverse cuts have recently been added by myself, with the object of displaying the interior of the nest more clearly. The figure in our Transactions shows the upper part of the receptacle, and the twig which descends through its neck, thickly covered with the pupæ of the butterfly suspended by their tails—a most unusual mode of attachment among the Pierinæ, though not entirely unexampled. At some time in the period of over seventy years during which this specimen has been preserved, the dried pupæ have been attacked by some cabinet pest, as a result of which many have been detached from the wall of the nest, and several have crumbled away. Such of these loosened pupæ and their

fragments as could be collected are now cemented to a card and shown beside the nest, while among the pupæ still *in situ* will be seen the little bosses of silk in which the anal hooks of the detached pupæ were once engaged.

"Similar nests, presumably of this species, have been described by many travellers. Westwood (*loc. cit.*) quotes from Hardy's 'Travels in the Interior of Mexico' one such account; and another, by A. Sallé, will be found in the 'Annales de la Société Entomologique de France,' 1857, p. 20. The latter observer, who discovered his nests on the branches of a small *Arbutus*, quotes from Humboldt, *Essai politique sur le royaume de la Nouvelle-Espagne*, Paris, 1827, p. 28, under the name of *Capullos de madrogno*, a description of nests which must, it seems, also have belonged to this species. Humboldt gives a short account of the larva, which, however, he considered to be a 'Bombyx.'

"In the year 1900, Dr. Dyar exhibited two of these nests, which had been sent to Washington by Dr. Alfredo Dugès, of Guanajuato, Mexico. Dr. Dyar at the same time showed specimens of the larva, of which he has published a minute description (Proc. Ent. Soc. Washington, vol. iv, 1901, pp. 419, 420). The food-plant was stated to be a species of *Arctostaphylos*. In the discussion which followed this exhibit, Dr. Dyar said that this was the only social butterfly known to him. It is no doubt rare in the extreme for the gregarious habit and the construction of a common abode to be carried so far in the case of butterflies as in the present example, but there is possibly at least one other instance to be found among the Pierines. I refer to *Neophasia terlootii*, Behr, which also inhabits Mexico and Arizona, and is stated by its describer to feed on an *Arbutus*, the larvæ forming common habitations in which they pupate gregariously. I cannot, however, avoid the suspicion that the nest of *Eucheira* has by some mistake been attributed to *Neophasia*, though the testimony of Behr with regard to *N. terlootii*, originally published in 1890 and repeated in a letter to Dr. Skinner in 1900, certainly appears to be explicit enough. This latter butterfly is especially interesting as possessing a female which closely resembles some of the mimetic forms of *Euterpe*. (See Proc.

Calif. Acad. Sci., 2nd series, vol. ii, 1890, p. 91; Ent. News of Philadelphia, vol. xi, 1900, pp. 331, 413, 533, Pl. II, fig. 28, and Pl. XIV.) I am not aware that the method of pupal suspension in this species has been recorded, but the pupa of the other species of *Neophasia*, viz. *N. menapia*, Feld., is stated by H. Edwards to be invariably attached with the head upwards. (Proc. Calif. Acad. Sci., vol. v, 1875, p. 165.) Behr is of opinion that the two known species of *Neophasia* should be referred to the genus *Eucheira*; this, as I have elsewhere stated (Trans. Ent. Soc. Lond., 1904, p. 304), seems to rest on insufficient evidence, though there is doubtless some affinity between the two genera, and both belong to an early Pierine stock. When the life history of the primitive Pierines (*Metaporia*, *Pontia*, etc.) of Central Asia is better known, it will be interesting to see whether the social habit and community of larval shelter will be found to prevail with any of these in a form at all comparable with those of their relatives on the other side of the Pacific. As I have before suggested (Trans. Ent. Soc. Lond., 1904, p. 303), it seems not at all unlikely that the common larval habitation of *Pontia* (*Aporia*) *crataegi*, rudimentary as it is, and belonging only to the early larval stages, may be a degenerate or undeveloped form of the elaborate silken nest constructed by the not very widely-removed *Eucheira socialis*."

Dr. W. J. Holland, of Pittsburg, Pa., U.S.A., said that although he had been a Fellow of the Society for many years, this was the first meeting which he had ever attended, and he regarded it as a rather peculiar coincidence that the subject under discussion should be one from the study of which he himself had just freshly come. Continuing his remarks, Dr. Holland said:—"In the early part of the past winter, the president of one of the Mexican railways showed me some pieces of a white silken web, remarkably tough and durable, which represented the covering of what he called 'a great cocoon,' abundant on the branches of the 'madroña' trees in the State of Durango, and always full of a multitude of caterpillars. I asked him to write at once to Mexico and request the superintendent of his railway to ship me a number of these silken bags. In due course of time I received a large

crate filled with them, and, fortunately, when the bags arrived, the caterpillars having passed the final moult, some of them were already pupating, and I was able to watch the process. The butterflies subsequently emerged, and as I had imagined from the outset, the insect proved to be *Eucheira socialis*, Westw., the males appearing in advance of the females. Oviposition took place within the silken bags in a number of instances, the females not coming forth, and I noticed that a number of the females, which appeared to be sluggish in their movements, did not attain a perfect normal expansion of the wings, as if there were already a tendency toward the development of a weakly-winged or possibly an ultimate apterous form; a phenomenon which is well known in the case of the 'bag-moths.' This abortion of the wings, however, may have been purely an accident, but it was rather remarkable that while all the males emerged with finally perfect wings—and there were some hundreds of them—a very heavy percentage of the females were either under-sized or partially aborted, crumpled, and unable to attain full development. Not having the proper food-plant, I was, of course, unable to work out the life history of the larvæ, although I preserved a large number of them both in spirits and inflated. That this insect is congeneric with *Neophasia menapia* and *N. terlootii* I do not believe, and in this respect I quite agree with Dr. Dixey.

"In conclusion, it may be interesting to recall that my friend, Professor Carl Lumholz, in his recent book on Mexico, figures a group of Indians engaged in extracting the caterpillars from those silken tents. They are a staple article of diet among some of the mountain tribes, and I am told that the forests in places are literally white with the big silken webs, many of which are five or six times greater than the original specimen described and figured by Professor Westwood, and now before us.

"Meanwhile I have written a fully-illustrated article on the subject, which will shortly be published, covering my observations upon this interesting subject."

Professor E. B. Poulton, F.R.S., read the following note recently received from Mr. S. A. Neave, B.A., F.E.S. The

observation supplies further interesting evidence of the superstitious dread of larvæ with terrifying eye-like markings (Trans. Ent. Soc. Lond. 1902, pp. 399–401):—

"Petauke, Fort Jameson,
N.E. Rhodesia.

"*January* 4–5, 1905. While here my boys brought me a specimen of Sphinx larva with terrifying markings. I think this must be the *Chærocampa osiris* mentioned by Marshall (Trans. Ent. Soc. *vide supra*), but I have written a description of it in case it should prove to be different. I can add some further interesting evidence as to the value of its terrifying markings. It most successfully imposes upon the natives, who will not actually handle it at any price, and say they are afraid of its 'eyes.' I have asked I should think fifty natives and they all consider the ocellated spots to be eyes. They have also a superstition that it jumps out of the bush and up a man's nostrils. This is all the more interesting when we remember that *all other* species of Sphinx larvæ that I have yet seen, besides many other Lepidopterous larvæ, are *eaten* by the natives and much searched for, being considered a great delicacy. They have different names for different species, which shows their great interest in them."

"*Jan.* 14. I have several of the *Chærocampa* larvæ in captivity and three have just pupated. They spin a very slight web, with large meshes of tough silk around them. The natives were unaware of the metamorphoses of these larvæ and were very astonished to see the pupæ. They are inclined, I think, to attribute it to magic on my part!"

Papers, etc.

The President read the following note on experiments conducted by him to ascertain the vitality of pupæ subjected to submersion in water:—

"The popular impression, as often shown in the newspapers, that severe winters are specially destructive to insects is well known to be unfounded, as our native insects in the hibernating stage will bear lower temperatures than they are ever exposed to, but I am not aware that there is any

positive evidence as to the effect upon them of floods. As regards many pupæ, which bury themselves in earth in low-lying localities it is certain that lengthened submergence cannot be injurious, for they must frequently be many days under water, yet survive. It does not however follow that pupæ which habitually are high and dry (and most of the common lepidoptera having subterranean pupæ evince a preference for such situations) would similarly escape. With the object of learning something definite on this point, I tried some experiments in the winter of 1901–2, supplementing them in the winter of 1904–5.

"I was able to obtain the following species for the purpose :—*Phalera bucephala*, which buries without a cocoon; *Drepana falcataria* (with which a few *D. curvatula* were mixed) and *Selenia bilunaria*, which both form close but thin cocoons between united leaves; *Cochlidion limacodes*, which forms a dense egg-shaped cocoon; and *Araschnia levana*, which is naked, and, being attached, as I have observed in the many hundreds I have bred, to deciduous nettle leaves and leaf-stalks, must pass the winter on or near the ground among the leaves and refuse which gather at the bottom of the stumps of dead stems.

"The pupæ were kept in unglazed earthenware jars which were placed in an ordinary flat sponging bath which stood on a table close to an open window facing north-west. Many were kept thoroughly submerged during the whole of their periods of immersion, being deprived of any opportunity of floating by means of earth in the case of *bucephala*, of thoroughly soaked moss in the other cases. In 1902 they were thus submerged from the 2nd February onwards, the weather being very cold, so that ice formed several times upon the water in which they were plunged.

"The treatment was as follows :—

	Submerged.	*Not Submerged.*	*Removed from the water.*
bucephala	73	10	6 day by day for 12 successive days.
falcataria	127	27	6 ,, ,, 21 ,, ,,
bilunaria	18	20	about 4 ,, ,, 5 ,, ,,
limacodes	75	12	5 ,, ,, 15 ,, ,,
levana	84	20	5 ,, ,, 17 ,, ,,

Of the *bucephala* submerged, 24 emerged after 1, 2, 3, 4, 5, 6, 7, 10, 11 and 12 days respectively, many more afterwards ; of the unsubmerged 8 emerged. Of the *falcataria* and *curvatula* at least 66 emerged after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 days (10 of the pupæ submerged had first slipped out of their cocoons, and 8 of these emerged) ; of those unsubmerged about the same proportion emerged ; of the *limacodes*, nearly all emerged ; of the submerged *levana* only 3 emerged, after 1, 3 and 9 days respectively.

"Of the submerged *bilunaria* not one emerged, but of the 20 unsubmerged 13 emerged. That result was so surprising as compared with the other submerged pupæ that I thought the fatal consequences might have been owing to the fact that the 18 pupæ had been deprived of the protection of their cocoons (though this had not affected the *falcataria*). Therefore in the winter of 1904–5 I tried the experiment with this species on a large scale. Of 50 submerged in their cocoons and taken out in lots of about 4 for 12 successive days nearly all emerged, very few being cripples, but of 23 submerged naked and taken out in from 1 to 5 days, only 2 emerged, both cripples. Of 34 other naked pupæ not submerged the great majority have emerged, about a quarter of them cripples, while of 50 left in their cocoons, but unsubmerged, nearly all have emerged, very few of them being cripples.

"The inference to be drawn from these experiments appears to be that in the case of subterranean naked pupæ submergence for 20 days is not injurious. Of moth pupæ that are not subterranean, such as *falcataria*, *limacodes* and *bilunaria*, submergence for 12 days or more is not injurious, with the proviso that if *bilunaria* is without its cocoon it will almost always be killed even if the submergence is only for a day. As to *levana* the pupæ were probably unhealthy, as shown by the large number of the unsubmerged that died ; the numbers of both that survived are too few for any decided inference, but it is established that this naked pupa can survive submergence for 9 days.

"The power of resistance of pupæ to submergence seems

very superior to that of larvæ, many of which I have found drowned after a very few hours in water. Of course the number of species experimented on by me is much too small for a very wide generalization ; still it has been shown to be a fact that several kinds of lepidopterous pupæ, fair samples, I think they may be called, will survive submergence for many days in water, and my figures show that just as large a proportion survive many days of it as survive a single day. It should perhaps be observed that the submergence of all the pupæ tried was completed many weeks before the imago was due to emerge, with the partial exception of the *bilunaria* tried in 1904–5, a very few of which, kept in a cold, fireless room, emerged before and during the term of experimentalism ; it does not follow that submergence would have been as harmless after the pupa had got over its winter lethargy and was moving towards emergence; this might be tested by experiments on short-lived summer pupæ."

A discussion followed in which Mr. A. W. Bacot, Mr. R. Adkin, Professor E. B. Poulton and other Fellows participated.

Mr. G. T. Bethune-Baker contributed "A Monograph of the Genus *Ogyris*."

Mr. H. A. Byatt, B.A., read a paper on "*Pseudacræa poggei* and *Limnas chrysippus*; the Numerical Proportion of Mimic to Model."

Wednesday, May 3rd, 1905.

Mr. F. Merrifield, President, in the Chair.

Election of a Fellow.

Mr. J. Butterworth, B.Sc., of "Comrie," Eglinton Hill, Plumstead, S.E., was elected a Fellow of the Society.

Exhibitions, etc.

Mr. M. Jacoby exhibited a series of *Xenarthra cervicornis*, Baly, from Ceylon, and drew attention to the curious structure of the antennæ of the ♂ those of the ♀ being quite simple. It

now being generally considered that the antennæ are olfactory organs, the complication of joints was all the more remarkable.

Mr. G. T. Porritt exhibited specimens of *Tephrosia consonaria*, ab. *nigra*, and melanic examples of *Boarmia consortaria*, all from a wood in West Kent, by Mr. E. Goodwin. These forms were exactly on the same lines as the melanism in West Yorkshire, and it is curious they should occur in such widely separate localities. The two genera, however, are evidently prone to melanism, as Mr. Porritt had now seen black or almost black specimens of all the British species except *Tephrosia punctulata*.

Commander J. J. Walker exhibited (1) two specimens of the very rare Staphylinid, *Medon castaneus*, Grav., taken in the Oxford district during the last week of April 1905; (2) several examples of both sexes of the giant flea *Hystrichopsylla talpæ*, Curtis, from field-mouse nests in the same district; and (3) the type-specimen of the Bostrichid beetle *Dinoderus ocellaris*, Steph. (taken by the late Prof. Westwood at "Little Chelsea" previous to 1830), from the Hope Collection at Oxford.

With reference to the last exhibited he also contributed the following note:—

"*Dinoderus ocellaris*, Steph. (Ill. Mandib. III., p. 352, footnote [1830]), † Sp. 2, ocellaris. *Nigro-piceus, subnitidus, antennis pedibusque piceis, elytris punctatis, punctis ocellatis in striis digestis.* (Long. corp. $1\frac{1}{2}$ lin.) Di? ocellaris *mihi*. Pitchy-black, slightly glossy; thorax tuberculate in front, punctate posteriorly; elytra rather deeply punctate, the punctures disposed in striæ, distinctly ocellated, and largest posteriorly; antennæ and legs piceous. I have little doubt of this insect being congenerous with the foregoing, but the antennæ are broken. Taken at 'Little Chelsea' in July last. —Mr. Westwood. It is probably exotic, having been found in a cup of coffee."

"The British species" (of the family Bostrichidæ) "are few in number, of small size, and considerable rarity; indeed it is not improbable that some of them are not really indigenous, but have been imported in timber, etc., from abroad, as in the instance of *Dinoderus ocellaris*, described by Mr.

Stephens, from my collection, which I found floating in a cup of coffee."—Westwood, Int. Mod. Classif. Insects, I., p. 278 (1839).

Professor E. B. Poulton, F.R.S., read the following note on "Heliotropism in *Pararge* and *Pyrameis*," communicated by Dr. G. B. Longstaff, M.D.:—"Following up my observations on the attitude at rest of *Pararge schakra*, Koll., made near Simla in October 1903,* I paid a good deal of attention in February and March of the present year to *P. meone*, Cram., a butterfly that I found in varying numbers in all the parts of Algeria that I visited. This is either a southern form of *P. ægeria*, L., or a closely allied species in which the yellowish spots are replaced by fulvous. It is fond of settling on sandy roads, rocks, walls, or the leaves of trees or shrubs, comparatively rarely visiting flowers. It first pitches, invariably I might say, with its wings about three-quarters expanded, and in the vast majority of cases with its back to the sun, the axis of the body being rarely more than 45° to either side; immediately after settling it more often than not adjusts itself, by a quick movement, so as to make its tail point fairly accurately to the sun. After this adjustment, if at all, it closes its wings over its back, and as a necessary result its shadow is reduced to, or approximates to, a mere line. There can, I think, be no doubt that this habit is a great protection to the insect, since when resting on fairly flat surfaces the shadow of a Satyrine or Nymphaline butterfly with cryptic under-side is often more conspicuous than the fly itself.

"I quote two cases from my notes:—

"Feb. 8, Guyotville. Watched a specimen settle about twenty times. The wings were always at first expanded about three-fourths, an adjustment of its position was in most cases made immediately, and after that the wings were raised over the back. In about twelve cases the orientation was perfect and the shadow a minimum; in seven or eight cases the orientation was imperfect, with a maximum error of about 45°, but usually much less.

"Feb. 25, Biskra. Watched one settle three or four times, always with a shadow near the minimum.

* See Trans. Ent. Soc. Lond., 1905, p. 67 and 136.

"Only one specimen of *P. meone* was ever seen to settle *facing* the sun; it did so three times, a fourth time turning its tail in the usual way. This was at Biskra on March 5th, and I noted at the time that the sun was not shining strongly. Two only were observed to settle with the axis of the body at right angles to the sun. One of these appeared to be crippled in the legs, since it alone always sat on one side. A third specimen, feeding on laurustinus flower in the Chabet Gorge on March 18th, did not appear to orient itself by the sun.

"In conclusion, except early in the day, or when the sun is dull, or when feeding on flowers, *P. meone* settles with the axis of the body turned so that its tail points more or less accurately to the sun, therefore when the wings are raised, in the attitude of repose (as is more common towards the afternoon), the shadow is reduced to insignificant dimensions.

"*Pyrameis cardui*, L., is an abundant butterfly in Algeria. It is not so easy to watch as *P. meone*, for it is a strong flier and much more wary; moreover, many of the specimens were seen in exposed places during windy weather. Nevertheless, I can say confidently that it generally settles with its tail to the sun, though it does not do this with the regularity of *meone*. I saw two specimens turn their faces to the sun, and saw a third settle twice with its body axis at right angles, though the third time it settled normally. The first two freshly emerged specimens, at Hammam R'ihra, March 25th, did not orient as well as those that had hybernated.

"These observations confirm those of Professor G. H. Parker on *Vanessa antiopa*, L., and on a *Grapta* in the United States,* and supply a reason for the habit that does not appear to have occurred to him, namely, concealment when in repose."

A discussion followed in which Dr. W. J. Holland said that he had not noticed this tendency to orientation. In the case of *Colias philodice* and other *Pieridæ*, he had observed that they assumed all manner of positions, so that it was not safe to extend the observation presented by Professor Poulton to such species. The President asked for information on the resting habit of *Selenia bilunaria*, and remarked that it differed in his observations from that of *S. tetralunaria* and the other

* Referred to Trans. Ent. Soc. Lond., 1905, p. 136.

members of the genus. Mr. C. O. Waterhouse remarked that he had noticed that butterflies always turn *to* the sun, so as to expose the greatest amount of surface to the warmth. Mr. G. C. Champion also mentioned that when collecting in the tropics he found that a dead butterfly exposed to the sun's rays at once shrivelled up. Mr. C. J. Gahan, Dr. F. A. Dixey, and other Fellows also joined in the discussion.

Papers.

Professor L. C. Miall, F.R.S., communicated a paper on "The Structure and Life History of *Psychoda sexpunctata*, Curtis," by John Alexander Dell, B.Sc.

Dr. D. H. Hutchinson gave an address on "The Three-colour Process as applied to Insect Photography," illustrated by lantern slides of British and Indian Rhopalocera, the exhibits showing a marked advance in accuracy of wing coloration to any yet shown at the Society's meetings. The President at the close of the Proceedings heartily congratulated Dr. Hutchinson upon the results of his work.

Wednesday, June 7th, 1905.

Mr. F. Merrifield, President, in the Chair.

Obituary.

The decease was announced of Lieut.-Col. L. H. L. Irby, F.L.S., F.Z.S.

Election of an Honorary Fellow.

Herr Ludwig von Ganglbauer, of the Vienna Museum, was elected an Honorary Fellow of the Society.

Election of Fellows.

Mr. Charles J. Grist of "Apsley," Banstead, Surrey; Mr. Vernon Parry Kitchen of the Priory, Watford, Herts.; and the Rev. W. Mansell Merry, M.A., of St. Michael's, Oxford, were elected Fellows of the Society.

Exhibitions.

Mr. M. Burr exhibited an earwig, *Apterygida arachidis*, Yers., found by Mr. Annandale of Calcutta, in a box of specimens received from the Andaman Islands. When placed in a small box, it was alone, but next morning there were five larvæ present; two disappeared, apparently being consumed by the parent; and the remaining three were those exhibited. Mr. Burr also showed a Locustid of the family *Pseudophyllidæ* taken in Queensland by Mr. H. W. Simmonds, a Fellow of the Society, among twigs and plants which it greatly resembled, together with a photograph of the insect in its natural position.

Mr. E. C. Bedwell showed (1) three examples of *Gnorimus nobilis*, L., taken at Woolwich on May 20th last under the bark of an old dead cherry tree, a beetle of which Canon Fowler writes that it seems to be becoming extinct in Britain; and (2) a malformed specimen of *Lochmæa suturalis* which had the left posterior tibia bifid for about one-third of its length, and two tarsi, one of which had the joints considerably enlarged.

Mr. O. E. Janson brought for exhibition a living specimen of *Omophlus betulæ*, Herbst, a beetle not known to occur in Britain, found by his son near Covent Garden, and probably imported.

Mr. W. J. Lucas exhibited one ♂ and three ♀ ♀ of *Agrion armatum* taken this year by Mr. F. Balfour Browne and sent to him alive. This dragonfly, scarce everywhere, was added to the British list by Mr. Browne about two years ago.

Mr. G. C. Champion showed four specimens of the rare *Acrognathus mandibularis*, Gyll., captured on the wing towards sunset near Woking at the end of May.

Mr. Selwyn Image exhibited two aberrations of *Biston hirtarius*, both females, taken by himself at rest on tree-trunks at Mortehoe, North Devon, April 23rd, 1905. The first aberration was tolerably normal in general coloration, but the anterior half of the fore-wings was much suffused with fuscous, and at the costa broadly emphasized with rich

black. The transverse lines on the hind-wings, all unusually distinct, were also dark, and broad throughout. The second aberration was semi-transparent black all over both fore- and hind-wings, the veins strongly delineated with black, powdered with ochreous. All traces of transverse lines and bands were obsolete in both wings, except a narrow pale-ochreous subterminal band, and this also nearly obsolete in hind-wings. The head and thorax were black dusted with ochreous, the abdomen totally black, and the legs and antennæ immaculate black.

Mr. W. J. Kaye showed a number of empty pupa-cases of *Zonosoma pendularia* to demonstrate the wide variation of methods in the placing of the silken girth round the pupa. The two extreme instances were—(1) where the girth went over the meso-thorax, and (2) where the girth was round the fourth abdominal segment. The average was close to the third abdominal segment. Allusion was made to Prof. E. B. Poulton's experiment with *Pieris brassicæ* and *Pieris rapæ*, as given in the Presidential address delivered in January 1905. This experiment went far to prove that those species were incapable of showing variation in this particular respect of pupal girth, because there was a specially strengthened groove to receive the silken strand and it was proved that the ordinary tegument of the pupa was unable to withstand the strain, at least when the pupa was in an unnatural position. But in the case of *Zonosoma pendularia* there is no groove present and the pupa is able to undergo development with the silk girth placed very variously, and it is only necessary for the pupa to be secure, the girth being in reality loose and having no definite position rather than a variable one. In one of the pupæ the excretions were at the head end, showing that the pupa must have been placed upside down.

Professor E. B. Poulton, F.R.S., exhibited leaves of strawberry, *Berberis japonica*, and cherry-laurel which had been sent to him by Mr. W. B. Grove, of Handsworth, Birmingham. The leaves had been attacked by minute fungi which, in the strawberry and *Berberis*, had been identified by Prof. S. H. Vines, F.R.S., as *Phyllosticta fragaricola* and *Phyllosticta japonica*, respectively. The clean round holes in the laurel

leaves had been caused by a fungus identified by Mr. George Massee as *Cercospora circumscissa*, Sacc.,—the "shot-hole fungus." The attack was local and followed by the death and disappearance of the central portion of the leaf-tissue of each patch, leaving a roundish or oval window outlined with brown, sometimes in the form of a narrow line, sometimes spreading peripherally into the leaf for a greater or less distance. In the strawberry the edges of the windows were somewhat ragged, but those of the other two leaves had smooth contours, and strikingly resembled the oval transparent areas upon the fore-wings of *Kallima inachis*, *paralekta*, etc.—surrounded most conspicuously with a marginal zone of modified colour varying greatly in different individuals as regards both tint and breadth. Professor Poulton had believed that these "windows" of *Kallima* represented holes gnawed by larvæ and that the altered marginal zone reproduced the effect of the attacks of fungi entering along the freshly exposed tissues of the edge. But he now desired to withdraw his earlier hypothesis in favour of the more probable and convincing suggestion made by Mr. Grove. The origin of the suggestion is of some interest in relation to the meetings of their Society and other associations which promote the intercourse of naturalists. Professor Poulton in the course of the "Huxley Lecture," recently delivered by him in the University of Birmingham, had explained his hypothesis and illustrated it upon the screen. Mr. W. B. Grove heard the lecture and forthwith proceeded to develop a sounder hypothesis.

Professor Poulton also showed a photograph of the fungus-like marks on the wings of the Oriental Kallimas, prepared under his direction by Mr. Alfred Robinson of the Oxford University Museum. The photograph was taken with oblique illumination, and shows, somewhat magnified, the tall upstanding scales which form the centre of each well-marked patch, as well as the pronounced shadow cast by them. They doubtless represent, in form as well as in colour, the fructification in the centre of a patch of leaf-attacking fungus, perhaps the very kinds which at a later stage of their development produce the "windows" represented on another part of

the wing-surface, perhaps some other common tropical Cryptogam.

Dr. Karl Jordan communicated the following note upon the Variability of the Genitalia in Lepidoptera :—

"For a long time it was the opinion of systematists that the organs of copulation in insects were practically constant within a species, and that therefore a form of insect which was found to be different in these organs was a distinct species. I demonstrated about ten years ago with Lepidoptera, and have since done so on several occasions, that there is a certain amount of individual variability, and that this variability in the organs of copulation is independent of the variability in other organs, for instance in the wings. Individuals which are aberrant in pattern are normal in the copulatory organs, and specimens with marked deviation from the typical in these organs have normal wing-patterns. Dimorphism in the wings, so strongly marked in many Lepidoptera, is not accompanied by differences in the organs of copulation.

"On the other hand, I have found that there is often a more or less marked geographical variability in the organs of copulation accompanying variability in the wings, a geographical variety of a butterfly or moth being in most cases characterised by some distinction in the wing and the organs of copulation. The bearing, on the evolution of species, of this contrast of geographical and non-geographical variation is obvious. It appears to me easy to understand why the specimens of the same locality, which copulate together, are on the whole the same in the organs of copulation, but it is more difficult in the case of seasonal varieties. If the causes of seasonal variation have anything to do with the origin of new species, one should expect that seasonal forms, which are often so very different from one another in the wings, were also different in the organs of copulation. I have examined many seasonally dimorphic species without result. Lately, however, I have come across a solitary instance of seasonal variability in the organs of copulation. The spring form of *Papilio xuthus* is slightly but distinctly and almost constantly different from the summer form in the "harpe" of the

clasper, the dentate portion of the "harpe" being proportionately longer in the summer form than in the specimens of the spring brood.

"This case of variability is of importance for the systematist as well as the evolutionist. It disposes of the opinion still held by many systematists that a form with some distinction in the organs of copulation is a species, and it demonstrates at the same time that a species can be split up by natural causes into forms which differ morphologically like species in organs of such importance for the preservation of the species as are the organs of copulation."

Mr. J. W. Tutt remarked that among the "Skippers" there are one or two species ranked as such on the variation of the genital organs, and he drew special attention to one described by Mr. H. J. Elwes and Mr. J. Edwards allied closely with *Syricthus malvæ*, viz. var. *malvoides*, Elw. and Edw., Trans. Zool. Soc. Lond. xiv, p. 160, Pl. XXIII, figs. 27–27*a*. He also suggested that a more definite statement as to whether the genitalia vary side by side with wing differences would be useful to determine whether the individual form was merely a form or constituted a distinct species. Mr. H. J. Elwes said that in the work alluded to Mr. Edwards was responsible for the parts dealing with the genitalia as a means of identification of species. As a rule he was loth to accept the genitalia alone as proof, but in the species of *Syricthus* mentioned Mr. Edwards had actually found the genitalia distinct.

The subject was further discussed by Mr. G. C. Champion, Mr. M. Jacoby, the President, and other Fellows.

Dr. G. B. Longstaff read the following observations on scents in the male of *Goneptery.c*:—

"At Hammam Meskoutine, Algeria, on March 15th, 1905, while examining my captures towards the close of the day prior to writing the data on their envelopes, I was struck with the sweet scent of a ♂ *Goncpteryx cleopatra*, L. All the three dead specimens which I had taken that day had the scent, but in two it was faint. On March 19th, at Bougie, I confirmed this in a living specimen, describing the scent at the time as 'sweet, rich, thick—suggesting *Freesia*.'

At Hammam R'ihra I submitted living ♂ *cleopatra* to four ladies; one could not detect the scent, another could not describe it, a third compared it to primrose, the fourth compared it first to gorse, then to faint 'Syringa' (meaning *Philadelphus coronarius*). Personally after more experience I hesitate between *Freesia* and 'Syringa.' Altogether up to March 31st, when it was getting over, I examined nineteen male *G. cleopatra* and found the scent quite distinct in all save one.

"Though not as abundant in Algeria as *G. cleopatra*, our more familiar *G. rhamni*, L., is sufficiently common, and naturally I examined that species, or form, for scent. To my great surprise out of ten specimens examined not one had a scent at all like that of *cleopatra*, indeed in most of them I could detect no scent whatever! One day in the hotel garden at Hammam R'ihra, I caught within a space a few yards in extent, and within a quarter of an hour, five butterflies in the following order :—1 ♂ *rhamni*, 3 ♂ *cleopatra*, 1 ♂ *rhamni*; all the three *cleopatra* had the scent, but neither of the *rhamni*.

"The one specimen of *cleopatra* in which no scent was detected was tested on a day when my nasal mucous membrane was somewhat inflamed, moreover a neighbouring pig-stye was distinctly a disturbing element. For these reasons I do not include in the above numbers 2 ♂ *rhamni* examined under the same conditions with negative results.

"The living *Gonepteryx* can be easily held by the thumb below and the forefinger above the thorax, the wings being expanded, and so examined without appreciable injury to the specimen, in a way that the more delicate structure of most butterflies renders impossible.

"These surprising results struck me so much at the time that I took care to assure myself that I was not deceived, but I trust other entomologists will repeat the observations when opportunity offers. Such a difference in the scent of the two forms must imply a physiological difference that would point to a specific distinction.

"In North Devon on the 29th of last month I examined a ♂ *G. rhamni* but could detect no scent."

Dr. F. A. Dixey exhibited specimens of several forms of

Gonepteryx occurring in the Palæarctic region, and commenting upon Dr. Longstaff's observations, said :—

"The facts relating to the scent of *Gonepteryx cleopatra* and *G. rhamni* which have just been laid before us by Dr. Longstaff are of very great interest, and certainly point in the direction of a real distinction between the two forms. I have occasionally detected a slight scent in British specimens of *G. rhamni* ♂, as recorded in our 'Proceedings' for 1904, p. lviii, but nothing like what Dr. Longstaff describes in *G. cleopatra*.

"It is by no means easy to determine the relation in which the forms of the genus *Gonepteryx* stand to one another, and I hope I shall not be thought to be wasting the time of the meeting if I say a few words on this subject.

"In the Canary Islands we have *G. cleobule*, Hübn., which is no doubt a distinct insular form. The fore-wings in the male are of a brilliant orange right up to the margin, while the hind-wings of that sex and the whole upper-surface of the female are tinged with paler orange. In *G. maderensis*, Feld., from Madeira, the males more nearly resemble *G. cleopatra*, Linn., and the females are also more deeply coloured than in *G. rhamni*. *G. cleopatra*, as is well known, is chiefly characteristic of the Mediterranean subregion. Its male shows a brilliant orange flush on the fore-wings which varies somewhat in size, but is always, I think, inferior in area to that of *G. maderensis*. In Syria, Asia Minor, and the Island of Cyprus occurs the form *G. taurica*, Stdgr. (*G. antonia*, Butl.), which is like *G. cleopatra* with its orange flush in a pale, washed-out condition. *G. rhamni*, Linn., occurs generally in Europe, including the parts of the Mediterranean subregion inhabited by *G. cleopatra*. Mr. Elwes records it also from the Altai. In the Levant, and as far east as Turkestan (Elwes), is found a form, *G. farinosa*, Mann., in which the wings of both sexes have a mealy appearance, due to semi-erect scales like those which characterise the borders of the wings in many species of *Catopsilia* and *Callidryas*. *G. nipalensis*, G. R. Gray, of which *G. carnipennis*, Butl., is perhaps a dry-season phase, is the form inhabiting northern India and the Himalaya. The male is of a deeper and richer yellow than that of *G. rhamni*, and both sexes often have the orange discoidal spots, especially of

the hind-wing, greatly increased in size. A similar form from China has an indication of an orange flush on the fore-wings in a still more attenuated form than *G. taurica*. This Chinese form appears to be a seasonal phase of *G. acuminata*, Feld., which inhabits the same districts, together with Burma, and is marked by extreme angulation of the wings. *G. zaneka*, Moore, is a similar highly-angulated form from northern India. *G. aspasia*, Ménétr., is an *acuminata*-like type from Amurland, and a large race of *acuminata* from Japan has been named *G. maxima* by Butler.

"Additional data concerning the local and seasonal occurrence of these various forms are much needed. In the meantime certain points appear to be tolerably clear. Each of the forms *maxima*, *acuminata* and *aspasia* seems to occur under two phases; one distinguished by a lower degree of angulation and a comparatively smooth surface in the wings of both sexes, and by a richer and deeper yellow in the colouring of the males; the other having the fore-wings strongly uncinated, with the wings showing a mealy surface much like that of *G. farinosa*, and the colouring in the male generally paler. There appears to be some reason to suppose that these parallel phases in the three forms have a seasonal significance, and they were arranged by Mr. Butler in the National Collection in accordance with that view; the smooth-surfaced, deeply-coloured, less highly-angulated phase being considered to belong to the wet season, and the other to the dry. If this be so, it is interesting to observe that the same relation between dry season and uncination of the fore-wing obtains in the case of this genus as in the other instances from Pierine genera (*Pyrisitia proterpia* and *Teracolus auxo*) to which I drew attention in the volume of our Transactions for 1903, p. 157, and Plate VII, figs. 1–8. It is also significant in relation to the principle there laid down, that the most highly angulated forms to be met with in the genus are the supposed 'dry-season' females, especially, it may be noted, those of *G. acuminata*. Now whatever be the relation between the two 'seasonal' phases of the three forms just mentioned, I have little doubt that the same relation holds between *G. nipalensis* and *G. zaneka*; and I am quite prepared to find that these two

are simply phases of the same species, the more markedly uncinate form *G. zaneka* belonging to the dry season, and the more deeply coloured form *G. nipalensis* to the wet.

"We have then, in passing from west to east, a chain of forms as follows:—*G. cleobule* (Canaries), *G. maderensis* (Madeira), *G. cleopatra* (Mediterranean), *G. taurica* (Levant), *G. nipalensis* and *G. zaneka* (N. India), *G. acuminata* (China and Burma), *G. aspasia* (E. Siberia), and *G. maxima* (Japan). These appear to stand to one another in the relation of more or less distinct geographical races; in some cases, as in that of *G. cleobule*, doubtless deserving the name of representative species. In passing from *G. cleobule* to *G. cleopatra* the orange flush diminishes in area but becomes heightened in colour; from *G. cleopatra* to *G. taurica* the area of the flush remains the same, but its intensity is lessened. In each of the forms ranging east of the habitat of *G. taurica* there are, as we have seen, two phases, perhaps seasonal in significance; one of which phases, resembling *G. cleopatra* more closely in contour, recalls it also by the reappearance, at least in the far eastern forms, of an indication of the orange flush.

"What, it may be asked, is the relation of *G. rhamni* to the other forms of the genus? If after studying the Asiatic forms in their 'seasonal' phases, we were suddenly confronted with *G. cleopatra* and *G. rhamni* for the first time, I believe we should be inclined to regard the two latter as also phases of each other, parallel with *G. nipalensis* and *G. zaneka*, or with the two forms of *G. acuminata*. But we know that whatever may be the relation between *G. rhamni* and *G. cleopatra*, it is not one of regular seasonal alternation. Are they to be regarded as completely distinct? If so, this would seem to carry with it a presumption that the supposed seasonal forms of *G. aspasia*, *G. maxima*, etc., have been wrongly associated; in which case the strongly acuminate, 'wet-season' forms, with *G. zaneka*, must be looked upon as geographical representatives of one species, viz., *G. rhamni*; and the less acuminate, 'dry-season' forms, with *G. nipalensis*, as the same of another species, viz., *G. cleopatra*. What evidence is there of a synepigonic kind? The statement met with in popular books, that *G. rhamni* and *G.*

cleopatra have been reared from the same parent, appears to rest on a passage in Westwood's 'British Butterflies and their Transformations,' 1841, p. 13, in which he mentions that M. Boisduval had informed him 'that he had reared *G. rhamni* and *G. cleopatra* from eggs deposited by the female of the former.' He adds a reference to Boisduval's Hist. Nat. Lepid., vol. i, p. 602, where, however, I find no statement about synepigony, though the author points out that the difference in shape which usually characterises *G. cleopatra* as compared with *G. rhamni* is not of constant occurrence. Specimens of *G. cleopatra* occasionally observed in Great Britain have doubtless been introduced; but Curtis's figure of *G. rhamni* with slight orange markings may probably represent a really British individual. On this part of the question, however, it will be allowed that Boisduval's alleged experience requires confirmation. As to syngamy, we have the interesting testimony of Mr. Bagwell-Purefoy ('Entomologist,' 1902, p. 304), who found that home-reared *G. rhamni* ♀, emerging in August, were persistently courted by *G. cleopatra* ♂, 'though whether any results were obtained is more than doubtful.' I would suggest that the reluctance of the female *G. rhamni* which Mr. Bagwell-Purefoy speaks of may have been due to the fact that this form, at any rate in the British Islands, does not pair until after hibernation.

"In favour of the view that *G. rhamni* and *G. cleopatra* are entirely distinct, we have the fact, explicitly stated by the last-named observer, that his *G. cleopatra* reared in Ireland under natural conditions were double-brooded, whereas *G. rhamni* is well known to be single-brooded, at least in a large part of its range. There is also the difference in contour, *G. rhamni* being much more acuminate than *G. cleopatra*. The food-plant, again, is said to be different. It would seem, however, that not one of these points is absolutely free from doubt. It is positively stated that *G. cleopatra* is single-brooded in some localities; and if it should turn out that, as has been asserted, *G. farinosa* is a second brood of *G. rhamni* in the eastern Mediterranean subregion, the supposed distinction would break down on both sides. Then with regard to contour, though the difference is usually well marked, it is

possible, as Boisduval pointed out, to find specimens of *G. rhamni* which are less acuminate than some specimens of *G. cleopatra*. We often find females which belong unmistakably to the *cleopatra* type, both in form and in colour; but beside these we get other females which in shape appear to be of the one form, and in colour of the other. Finally as to the food-plant. This in the case of *G. cleopatra* is said to be *Rhamnus alaternus* or *R. alpinus*. Mr. Bagwell-Purefoy's *cleopatra*, however, would not eat *R. alaternus*; but throve, like *rhamni*, on *R. catharticus*.

"Dr. Longstaff's very interesting observation must of course be allowed full weight. In reference to this it is remarkable that I have not found any scales in either *G. rhamni* or *G. cleopatra* which appear to be specialised for scent production; nor do I find any microscopic difference between the ordinary scales of these two forms, except in the matter of pigmentation. Further information as to all these forms would be very welcome, especially in the case of *G. farinosa* and its possible relation with *G. rhamni* and *G. taurica*, in company with the latter of which forms it was found flying by Mrs. Nicholl on the west side of Lebanon towards the end of June (Trans. Entom. Soc. Lond., 1901, p. 81). Meanwhile, I think it may be considered as open to question whether in a portion of their range *G. rhamni* and *G. cleopatra* may not to some extent intergrade, though for the most part they certainly appear to be distinct enough.

"By the kindness of Professor Poulton I am able to exhibit to-night specimens from the Hope Collection of many of the forms that have been mentioned in the course of these remarks."

Mr. H. J. Elwes, F.R.S., read the following note on the Geographical Affinities of Japanese Butterflies, of which he also exhibited numerous specimens :—

"Twenty-three years ago (P. Z. S. 1881, p. 856, *et seq.*), I wrote my first entomological faunistic paper, 'On the Butterflies of Amurland, North China and Japan,' basing it upon the collections of Messrs. Jonas, Pryer, and Fenton. I then attempted to analyse the distribution of the species, which I classified as follows :—

Species common to and characteristic of the Palæarctic region	41
Peculiar to the Eastern part of this region, but mostly belonging to genera of Palæarctic affinity	62
Common to Indian region, or cosmopolitan in Old World	44
	147

"Last summer I made a short trip to this wonderfully interesting country, and though my objects were principally the study of trees and forests, I was able to collect in some parts of Japan little known to the ordinary tourist, a number of butterflies of great interest. Though I had carefully studied the best Natural History books on the country I had not in the least realised what were the climatic conditions which prevail in summer, which have had a much greater influence upon the character both of the vegetation and the insects than I could have believed without seeing it. On many occasions I was struck by the remarkable similarity of the forest and the forest insects, even as far north as central Hokkaido (usually known in England as Yezo) to the middle region of the Sikkim Himalayas at about 8–10,000 feet; and even in the low country in the months of July and August there is more to remind one of India than of Europe. The collections which I made, though very scanty in point of numbers, fairly represent the character of the Butterfly fauna, which, as you will see, contains a great number of Himalayan genera and very few species really characteristic of Northern Europe and Asia. No doubt in the spring this would not have been the case; for though Pryer has stated in 'Rhopalacera Nihonica' (p. 2) that the Fauna is decidedly Palæarctic, and my own analysis indicates a greater affinity to the Palæarctic region than to the Indian, yet the species which were most numerous in the forests almost all belong to Indian genera; characteristic Palæarctic genera and species with the exception of *Argynnis* and *Pieris* were almost always few in number, and the most generally distributed and common species of Europe and Northern Asia were

either absent, or so much altered in appearance, that they might almost be treated as different species. A short analysis of my collection shows this clearly. Amongst the Satyridæ, for instance, there is not a single species found in Europe except *Satyrus dryas* and *Pararge deidamia*, the latter only taken in Hokkaido; whilst three species of *Lethe*, one *Neopæ*, one *Ypthima* and the large *Pararge schrenkii*—elsewhere only found in Amurland, which has very much the same faunistic characteristic as Japan,—were far more abundant. I did not see an *Erebia*, of which only one species is found in Japan, a *Cœnonympha* or an *Epinephele*, three of the most characteristic Palæarctic genera. In the Nymphalidæ, Vanessas except *V. urticæ* and *G. album* were rare in Hokkaido. *Melitæa* is only found in the higher mountains, all the smaller *Argynnis*, so characteristic of Europe, are absent; and *Neptis*, which is much more an Indian than a European genus, was almost the only abundant Nymphalid genus in Central Japan. Though *Apatura* and *Limenitis* are both common, yet *Dichorrhagia* and *Euripus* are quite as much so. Amongst the Pieridæ it is true the species are rather Palæarctic than Oriental, but *Terias* is quite as commonly seen as any of them, except in Hokkaido. In the Papilionidæ the only European species is *P. machaon*, whilst three or four truly Oriental forms are much more in evidence, and may be seen hovering about the roadsides and settling in front of the houses as in the Himalayas.

"Amongst the Lycænidæ the only common European form is *L. argus* or *ægon*. Though forms of several wide-ranging species such as *argiolus* and *argiades* are yet present, in Central and Southern Japan purely Oriental genera such as *Curetis*, *Niphanda*, *Dipsas*, *Amblypodia*, and in Hokkaido the green Theclas all give a very Himalayan character to the Butterflies. But it is amongst the Hesperiidæ that the truly Oriental character of the fauna is most strongly shown. Of the species I show to-night only one is really European, all the rest belonging to characteristic Indian genera; and this was equally the case in Hokkaido as in Central Japan. In the only day's collecting I had in the neighbourhood of Kioto I saw not one single European species except the ubiquitous *Colias hyale*, and if I had had time to visit the southern

islands of Kiusiu and Shikoku I have no doubt that the same feature would have been even more striking. This is not so much to be wondered at when one considers that for at least five months in the year, from the beginning of June to the end of October, the climate is really much more tropical than temperate, and enables tropical plants, such as *Caladiums*, Ginger, and Rice to be cultivated generally. It seems strange that this remarkable fact has not been previously brought out, or made clear by authors resident in Japan, and the tourist who visits the country usually in the autumn and spring does not realise the complete change that takes place during the rainy season. Briefly, one may say that though during the winter and spring months the plants and insects of Japan are, like the climate, Palæarctic in character, yet during the summer and autumn they are Tropical; and though, no doubt, we must not generalise too hastily from such a short experience as I had, yet it serves to show that one cannot realise the climatic and faunistic peculiarities of any country thoroughly without having personally visited it."

A discussion followed in which Mr. R. Trimen, Mr. J. W. Tutt and other Fellows participated.

Papers.

Professor Christopher Aurivillius communicated a paper on "New African *Lasiocampidæ* in the British Museum."

Mr. G. W. Kirkaldy communicated a "Memoir on the Rhynchota taken by Dr. Willey chiefly in Birara and Lifù."

Wednesday, October 5th, 1905.

Mr. F. Merrifield, President, in the Chair.

Election of a Fellow.

Mr. J. R. Davidson, of Drumsheugh Gardens, Edinburgh, was elected a Fellow of the Society.

Obituary.

The decease was announced of Mr. John William Douglas, the oldest Fellow of the Society, who was elected in 1845; Mr. George Bowdler Buckton, and Mr. Ambrose Quail.

Honorary Degree.

The President said that since the last meeting the University of Oxford had conferred upon Commander J. J. Walker, R.N., one of the Secretaries, the degree of M.A. *honoris causa* for his services to entomological science. After the announcement, which was received with loud applause, Commander Walker thanked the Fellows present for the kind way in which they had expressed their approval and interest.

Exhibitions.

Mr. Edward Harris showed some living larvæ of the Longicorn beetle *Cordylomera suturalis*, Chevr., taken from a log of mahogany imported from the Sekondi district of the Gold Coast, together with the perfect insect, which was dead at the time the discovery was made.

Mr. A. T. Rose exhibited a remarkable melanic specimen of *Catocala nupta* taken by Mr. Lewis in his garden at Hornsey, N., in September. The coloration of the lower wings was of a dull brown, and all the markings of the upper wings were strongly intensified. Mr. J. H. Carpenter said that a somewhat similar form had been taken by the late Mr. Mark Winkley at Mitcham, Surrey, on August 22, 1892. (*Cp.* Entomologist, xxv, p. 243.)

Mr. Norman H. Joy brought for exhibition Coleoptera taken during a three days' trip to Lundy Island in August. *Melanophthalma distinguenda*, Con., a species new to Britain; *Stenus ossium*, var. *insularis*, a variety apparently new to science; series of *Psylliodes luridipennis*, Kuts., and *Ceuthorrhynchus contractus*, var. *pallipes*, Crotch, peculiar to the island. One hundred and sixty-three species were taken on the island, about eighty of which are not recorded in Wollaston's and F. Smith's lists of Lundy Coleoptera.

Mr. Alfred Sich showed examples of *Argyresthia illuminatella*, Z., two of the four specimens taken near Hailsham, Sussex, on June 15th this year. They were beaten off *Pinus*, and until examined with a lens were supposed to be *Ocnerostoma piniariella*, of which species two were also exhibited for comparison. Afterwards they were thought to be *A. illuminatella*, and two specimens were sent to Mr. Meyrick, who has, by request, recorded the occurrence of the species in the Entomologists' Monthly Magazine.

Mr. W. J. Lucas exhibited the larva, cocoon, and the subsequent imago of an "ant-lion," *Myrmeleon formicarius*, from two Spanish larvæ given him by Dr. T. A. Chapman last autumn. The difference in size between the small larva and the large perfect insect was remarkable. He also showed a living ♀ of the rather scarce grasshopper *Stenobothrus rufipes*, taken in the New Forest at the end of August, and kept alive feeding on grass.

Mr. G. C. Champion exhibited several examples of *Lymexylon navale*, L., from the New Forest, whence it had not been previously recorded. Mr. H. St. J. Donisthorpe said that he had been the first Coleopterist to take it there.

Mr. A. H. Jones showed series of *Lycæna argus*, L. (*L. ægon*, Schiff.) var. *hypochiona*, a South European form, taken on the 16th July last on the North Downs; also for comparison specimens of *L. argyrognomon*, Brgstr. (*L. argus*, Esp.) from Sierre in the Rhone Valley, to which species they have a far greater resemblance on the under-side both in regard to coloration and the arrangement of the spots, than to typical *L. argus*.

Colonel J. W. Yerbury, who exhibited specimens of

Hammerschmidtia ferruginea, Fln., said that, although Mr. Verrall ("British Flies," p. 671) had recorded his opinion regarding the probable occurrence of one or more species of this genus in the British Isles, these were the first authentic British specimens. At Nethy Bridge this year Mr. Lamb of Cambridge and himself obtained during the month of June three ♂ ♂, three ♀ ♀. The insects were found resting on aspen logs in the birch woods, and were chiefly remarkable for the quiet manner in which they sat and allowed themselves to be boxed. Mr. Verrall (l. c., p. 475) expresses doubts as to the claims of *Hammerschmidtia* to rank as a genus. It is, however, a good one, and perfectly distinct from *Brachyopa*, though it seems to be very imperfectly known everywhere.

With regard to *Microdon latifrons*, Lw., which he exhibited also, Col. Yerbury said that at the meeting of the Society held November 3rd, 1900, he had shown a specimen of a *Microdon* taken at Nethy Bridge June 18th, 1900, which specimen he wrongly identified as *M. devius*, and under this name it was recorded in Verrall's "British Flies," p. 662; it seemed advisable, therefore, to exhibit a second specimen from the above locality, and to draw attention to the previous error. Only four examples of this species have so far been obtained within the United Kingdom. Of *Chamæsyrphus scævoides*, Fln., the single specimen shown was swept on June 15th, 1905, in the Abernethy Forest near Forest Lodge, while regarding *Cynorrhina fallax*, L., this insect occurred in some numbers at Nethy Bridge during the same month, numerous specimens having been taken by Mr. Lamb and himself.

Mr. H. J. Turner exhibited the imagines bred from the larvæ of three of the species of *Coleophoridæ*, exhibited by him during the year 1904, together with the leaves of their respective food plants, to show the character of the mines made by the larvæ. The larval cases were also shown mounted in the position they normally retain during life. The species exhibited were *C. alcyonipennella*, *C. lixella*, and *C. albitarsella*, as well as a similar life-history of a species he had not shown before, viz. *C. badiipennella*, the larvæ of which feed on elm. He also exhibited the living larvæ and their cases of three other species, which he had received the previous day through

the kindness of Mr. Eustace R. Bankes of Corfe Castle, and read extracts from the remarks which had accompanied them. (1) *Goniodoma limoniella*, Stn. "The larvæ you will find in plenty on the bunch of seed-heads of *Statice limonium* in their very inconspicuous cases consisting of the old flower and calyx: there are a few cases also on the stalks. You probably know that when full-fed the larva descends the stalks of the seed-head, takes up its position on some spot on the main stem (sometimes high up, often very low down on it), bores into it, hibernates therein, and pupates the following late spring or early summer. The case remains outside the stem, but, being only lightly attached, drops off in the course of the autumn or winter, so that, although one can collect the stems in the spring, one then gets no cases." (2) *Coleophora obtusella*. "These larvæ are very difficult to detect, the case being made of the seed-husks of *Juncus maritimus* on which the larvæ feed," and (3) *Coleophora glaucicolella*. "Larvæ of what I expect will prove to be this species, on seed-heads of *Juncus glaucus*, to which they show a decided preference." All three species were obtained by Mr. Bankes in the Isle of Wight.

Paper.

Commander J. J. Walker read a paper by Mr. A. M. Lea entitled "The Blind Coleoptera of Australia and Tasmania," and exhibited specimens of *Illaphanus stephensi*, Macl., from Watson's Bay, Sydney, N.S.W., and *Phycochus graniceps*, Broun, and *P. sulcipennis*, Lea, from Hobart, Tasmania.

Wednesday, October 18th, 1905.

Dr. T. A. Chapman, M.D., F.Z.S., Vice-President, in the Chair.

Election of Fellows.

Mr. Charles William Bracken, B.A. (Lond.), of 18 Whiteford Road, Mannamead, Plymouth, and Mr. William Hubert St. Quentin, of Scampton Hall, Rillington, York, were elected Fellows of the Society.

Donation.

Commander J. J. Walker announced that Mr. Charles D. Douglas had presented to the Society a framed photograph of his father, the late Mr. John William Douglas. A vote of thanks to the donor was carried unanimously.

Exhibitions.

Mr. H. Rowland-Brown exhibited a small collection of Erebias taken this year in the Pyrenees, including *Erebia lefebvrei*, with the varieties *pyrenæa*, Obth., from Mt. Canigou, E. Pyrenees, and var. *intermedia*, Obth., from Gavarnie. He also showed for comparison *E. alecto*, Hb., var. *nicholli*, Obth., from Campiglio, which at one time was supposed to be identical with *lefebvrei*, then considered the Pyrenean form of *E. melas*. With them were also shown specimens of *E. gorgone* from the Lac de Gaube, Cauterets, and from Gavarnie, and *E. gorge* from the same localities. Mr. Rowland-Brown remarked that whereas *lefebvrei* appeared to be confined to the stony detritus just below the snow line, where it flew with *gorge*, he only found *gorgone* on the grass pastures at an altitude of about 6,000 feet; and there it occurred in the Vallée d'Estaubé in some numbers on July 23rd.

The Vice-President, who showed a diagram of the clasps of *lefebvrei* and *melas*, said that in a previous year of the Transactions he had published the results of his anatomic examinations of the species, which showed that *lefebvrei* approached *pronoe* and *neoridas*, while the clasps of *melas* and *nerine* (diagram also exhibited) were practically identical. He also drew attention to the remarkable superficial resemblance of the under-side of the ♀ *gorgone* to that of the ♀ *goante*, a species not hitherto recorded from the Pyrenees.

Mr. Rowland-Brown included in his exhibition short series of *Lycæna orbitulus* from the Central Alps, *L. orbitulus*, var. *oberthuri*, Stgr., *L. pyrenaica*, and *L. pheretes* from the Brenner and Cortina districts. He said that with regard to the first three butterflies his observations confirmed those made by M. Rondou in his "Catalogue Raisonnée des Lepidoptères des Pyrenées," the *orbitulus*, which he found on the Col de

Puymorens, closely resembling the central Alpine form, while all those taken in the Central Pyrenees at Gavarnie and the Lac de Gaube were the darker and more robust var. *oberthuri*. He further suggested that, as between those species enumerated, there seemed to be a greater superficial affinity between *pyrenaica* and *pheretes* (not reported from the Pyrenees) than between *pyrenaica* and *orbitulus*. At Gavarnie the two latter were taken flying together, but were hardly emerged this year in the last week of July, and no ♀ ♀ were observed.

L. orbitulus, ♂. *L. pyrenaica*, ♂. *L.* var. *oberthuri*.

Mr. E. C. Bedwell exhibited eight specimens of *Apion lævigatum*, Kirby, one of the rarest indigenous Apions, found on August 31st, sheltering under plants of *Echium vulgare* in the Lowestoft district. The one ♂ taken was exceedingly diminutive, being only about 1½ mm. in size. Commander Walker said that he had this year seen one example of this beetle taken at Oxford, where it was known to occur.

Mr. R. Shelford showed several insects from Sarawak, Borneo, including (i) a Lygæid bug which had been taken burrowing in decayed wood: the fore-limbs exhibited a remarkable adaptation for fossorial habits, comparable with the modified fore-limbs of the mole-cricket (*Gryllotalpa*), which insect in Borneo is frequently found in decayed wood; (ii) a Brenthid beetle, with a deep channel running along the dorsal

part of the prothorax, the lips of which channel are nearly apposed, so that the channel communicates with the exterior merely by a narrow slit, and constitutes a nearly cylindrical chamber; this chamber is occupied by Acari; (iii) two Brenthidæ with deeply sulcated prothorax, in which Acari occur; the sulci in these two species not being "roofed in" as in the preceding species: and (iv) an Anthribid beetle with a crescentic sulcus on the prothorax.

Mr. C. J. Gahan, on behalf of Mr. C. O. Waterhouse, exhibited a living example of *Phaneroptera quadripunctata*, which species had been found in some numbers in a vinery near Chester. It is a Southern European species, and is not known as British. But a single specimen of an allied species *Phaneroptera falcata* was once taken near Land's End by Dr. Mason.

Mr. W. J. Kaye brought for exhibition a long variable series of *Heliconius numata* from the Potaro River, British Guiana. These included a very large number of different forms, from some with a narrow black bar across the hind-wing, to others with almost the whole of the wing of a deep black. The series clearly proved that these very variable forms were only aberrations, and were not sub-species, at least in this locality, as had been described by Riffarth, Weymer and others.

A pair of *Heliconius silvana* were also shown with two rare aberrations, showing the black area of the hind-wing divided; and examples of *Heliconius vetustus*, it being remarkable that although similar to *numata* it was nevertheless a distinct species.

Mr. A. H. Jones exhibited a collection of Lepidoptera made by him in Majorca during the first half of last June, and remarked upon the almost total absence of Lepidopterous life in the island. Only thirteen species of butterflies were observed, all of the commonest kinds and without any indication of variation, with about six species of moths (all occurring in Britain), including *Agrotis saucia*, *Acidalia ochrata*, and *A. degeneraria*, the latter, interesting in point of colour, being much redder. He also exhibited *Melanargia lachesis*, var. *canigulensis*, from Vernet-les-Bains, showing on the under-

side in the males a strong resemblance to *M. galathea*, also *Melitæa aurinia*, var. *iberica*, Obth.—(*desfontainii*, Rbr.) from Montserrat, near Barcelona, and a melanic specimen of *Erebia stygne*, taken by Mr. R. S. Standen last June at St. Martin du Canigou, Vernet-les-Bains.

Papers.

Mr. Frank P. Dodd communicated a paper "On a parasitic Lepidopteron from Queensland, Australia."

Commander J. J. Walker read a paper by Mr. E. G. B. Meade-Waldo, "On a Collection of Butterflies and Moths made in Marocco, 1900–01–02." The species enumerated included a *Cœnonympha* new to science, and a *Satyrus* not hitherto figured. But for so luxuriant a country as that visited it was remarkable how few butterflies and moths there were. Of the former only sixty-three were observed; of the latter one hundred, including a new sub-species of *Macrothylacia rubi*.

Wednesday, November 1st, 1905.

Mr. F. Merrifield, President, in the Chair.

Election of a Fellow.

Mr. J. W. H. Harrison, B.Sc. (Lond.) of The Avenue, Birtley, R.S.O., Durham, was elected a Fellow of the Society.

Exhibitions.

The Rev. F. D. Morice exhibited (1) *Panurgus moricei*, Friese, a species of bee new to science taken by him near Gibraltar, of which it was remarkable that whereas usually the species of this genus are entirely black, in this species the ♂ face entirely and the ♀ partly were bright yellow, the legs partly yellow, and the abdomen spotted down each side, very much as in *Anthidium*, and (2) the unique type-specimen of *Heriades fasciatus*, Friese, a ♂ of the *Chelostoma* group,

taken by him at Jericho in 1899, in which again, while all its congeners are practically unicolorous, the abdomen is banded, as in a wasp, with yellow. A discussion followed as to the reason of the peculiar coloration in the species under review, the exhibitor pointing out that the colour-mimicry in these species could not be due to parasitism, both *Panurgus* and *Heriades* being industrious genera. He also invited any information or suggestion which might explain the phenomenon, so common in various Aculeate genera, of a white or yellow face in the ♂, represented only by two spots or streaks, or often not at all, in the corresponding ♀. Professor E. B. Poulton, F.R.S., expressed his opinion that the species shown, though industrious, were mimics; and that the question as to the ♂ face was not at present answered, or answerable, but that it might perhaps be ascertained by experiment in what way it was of advantage to the ♂ to have this character which the ♀ did not need. The pale face in these and other ♂ bees could not be explained on the lines of mimicry, but might be used as a method of recognition. In the case of some Algerian *Aculeates* the light pubescent colouring of the head might assist as a protection to the insect when looking out of its hole in the sunshine. The coloration of the abdomen however suggested a case of mimicry. Mr. C. O. Waterhouse mentioned that with some *Buprestidæ* the front of the head in the ♂ was light, but unicolorous in the ♀; a peculiarity also observed by Mr. M. Jacoby in the genus *Cryptocephalus*.

Mr. W. J. Lucas showed a ♂ specimen of the earwig *Forficula auricularia* taken at Warwick in September last, with a drawing of the cerci (forceps), which were entirely abnormal, the broader basal part of the two appearing to be more or less fused together, while the legs of the forceps were jointed to the basal part. The case, he said, was interesting because in cockroaches, etc., the cerci are regularly jointed.

Mr. G. C. Champion exhibited various interesting insects from Guatemala recently received from Señor Rodriguez, including *Heterosternus rodriguezi*, Cand., *Pantodinus klugi*, Burm., *Plusiotis adelaida*, Hope, and a species of Orthoptera greatly resembling a dead withered leaf, possibly a new species of *Mimetica*.

Mr. Norman H. Joy showed two species of Coleoptera new to the British Islands :—*Læmophilus monilis*, F., taken in the neighbourhood of Streatley, Berks ; and *Dacne fowleri*, n. sp., from Bradfield, with specimens of *D. humeralis*, and *D. rufifrons* for comparison. He pointed out that *fowleri* differed not only in colour and structure from the two other species of the genus, but also in habits, as it was a quick runner.

Mr. H. St. J. Donisthorpe showed a specimen of a new British *Agathidium* (*Badium*, Er.) discovered last year in Cumberland, and now taken by him at Gibside, Durham, and specimens of *Prionocyphon serricornis* with a drawing of the hitherto unknown larva which he said he had taken under water in the hollow bole of a tree, in the New Forest, last July.

Dr. F. A. Dixey exhibited some specimens of African Pierine butterflies, together with alcoholic extracts of the wings of *Mylothris agathina*, Cram., ♂, and *Belenois severina*, Cram., ♂, and remarked upon them as follows :—

"It may be remembered that some little time since (see Proc. Ent. Soc. Lond., 1904, pp. lvi–lx) I gave a short account of various observations made by me in 1899, and subsequently, on the scents of several of our British butterflies, exhibiting at the same time preparations of some of these perfumes which still retained their distinctive qualities. During the present year I have had the opportunity of testing many of the African butterflies in the same way, and I now propose to give details of some of the facts that I have been able to observe in relation to their property of scent-production. In this investigation I have had the great advantage of the co-operation of Dr. Longstaff, who had already, at my suggestion, made a careful examination of the odours of many Asiatic butterflies, as recorded in the volume of our Transactions for 1905, pp. 61–144. I am further indebted to him for permission to include his own impressions of these perfumes.

"The scents now dealt with are of two kinds ; these may be roughly distinguished, in reference to their probable functional significance, as attractive and repulsive.

"The first class is, I think, of importance in courtship as a

means of sexual attraction and possibly of recognition. The odours belonging to this class, in all the species with which I am here concerned, are confined to the male sex. They have a general family likeness, recalling in most cases the perfumes of flowers, or of various aromatic vegetable products such as lemon-peel, spices, vanilla and chocolate. They are, I think, in nearly every instance agreeable to the average human perception.

"The scents included in the second class are probably made use of for defensive purposes. They occur, as a rule, in species which we have grounds for believing to be distasteful to some at least of the usual enemies of butterflies. They are found, as would be expected on this supposition, in both sexes; and they are for the most part disagreeable or even disgusting to the human observer. It is perhaps conceivable that both kinds of odours may occur in the same individual; though such instances, if they exist at all, would appear to be rare.

"The Pierine scents that have been examined belong to the first class—probably serving the purpose of sexual attraction and perhaps also of recognition. I subjoin a list of the African species in which they have been noted.

"*Catopsilia florella*, Fabr. When the tufts of hair-like scales present in the male are exposed by separating the fore- from the hind-wing, they emit a very strong, sweet scent, which Dr. Longstaff compares to that of 'tuberose' or *Freesia*, and to my mind suggests jasmine. (A similar scent was detected by Wood-Mason in the Indian *C. gnoma* [*pyranthe*]. See Journal of the Asiatic Society of Bengal, vol. lv., Part II, 1886, No. 4, p. 371.)

"*Colias electra*, Linn. The wings of a male specimen were separated, and the costal patches of the hind-wing smelt, with a negative result. The left costal patch was then scraped with a penknife and the detached scales tested, again with a negative result. The right costal patch was then gently scraped and the patch itself smelt. I immediately perceived a distinct flowery fragrance reminding me of heliotrope, with the added suggestion of chocolate. The scent, which was quite pleasant, corresponded very fairly with my recollection of that of *Colias edusa*, Fabr., obtained

in a similar manner (Proc. Ent. Soc. Lond., 1904, p. lvii). In the latter case, however, I was able to detect the odour in the detached scales.

"In two males similarly examined by Dr. Longstaff, the scent, although sweet, contained a disagreeable element which led him to compare it to that of 'bad sweetmeats.' This was not the case with the specimen above recorded by me, though I can confirm the observation with regard to one of Dr. Longstaff's males.

"Two specimens of *Teracolus achine*, Cram., ♂, emitted a distinct flowery perfume, something like that of honeysuckle. Another seemed to be devoid of odour; the female also was found to be scentless.

"The scent of *Teracolus annæ*, Wallgrn., ♂, is faint, but quite unmistakably present in some individuals. It is flowery, with a slight roughness or spiciness suggestive of heliotrope. Dr. Longstaff failed to detect a scent in one of his specimens, but found it very faintly present in a second. He is inclined to compare it with that of *G. rapæ*.

"In *Teracolus auxo*, Luc., ♂, the fragrance may be strong, in which case it resembles that of some heavily-scented white flowers such as 'Syringa' (*Philadelphus*) or jasmine. There is no suggestion of either lemon or rose—both of these being odours not uncommonly met with among Pierines. Dr. Longstaff, who found the scent faint (as I did in some instances), characterizes it as 'clean, flowery'; and compares it with that of *Ganoris brassicæ*, Linn.

"*Teracolus eris*, Klug, was only encountered in small numbers. A male caught by me on the banks of the Zambesi had a distinct flowery scent when fresh. A corresponding observation was made by Dr. Longstaff.

"In *Teracolus omphale*, Godt., ♂, I was invariably able to detect an odour, always well-marked and often strong. This odour in the first place resembled that of *T. auxo* in its likeness to the fragrance of *Philadelphus*; a possibly nearer comparison, however, being with the white lily. But in addition to this 'white-flower perfume' there was nearly always present an aromatic, almost 'snuffy' constituent of different character, hard to define; this gave to the scent a

certain roughness—not, as in *G. rapæ*, the roughness of sweetbriar—and suggested at one time chocolate, at another musk, while itself quite distinct from either. Two females of this species were found to be completely devoid of odour. Dr. Longstaff's results with *T. omphale* ♂ were largely negative. In three specimens, however, he found a fairly strong scent which he compares to that of *Freesia* or honeysuckle.

"The scent in *Teracolus ione*, Godt., ♂, cannot always be detected. When present, it is sweet, flowery, and apparently free from all traces of 'snuffiness.'

"*Eronia cleodora*, Hübn., ♂. In this form the intensity of the odour varies greatly; the scent is sometimes absent altogether, but when present may be strong. Its basis is a flowery perfume like that found in many species of *Teracolus*, but to this is superadded an aromatic element giving a distinct suggestion of sweet chocolate. Dr. Longstaff, who found the scent very faint in all his specimens, considers it to belong to the *G. brassicæ* type.

"*Belenois gidica*, Godt., ♂, appears in many instances to be without perceptible odour. Occasionally, however, I found it to possess an odour of roses, which in one of my specimens was strong. Dr. Longstaff's results were mainly negative, but in a few instances he reports a slight, sweet flowery perfume.

"A specimen of *Belenois mesentina*, Cram., ♂, emitted, when fresh, a scent much like that of *B. gidica*. In a second specimen no odour was detected.

"*Belenois severina*, Cram., ♂ shows, like *Eronia cleodora*, much individual variation in the matter of scent. An odour is, however, nearly always present in greater or less intensity, and to my mind is of the same general character as that of *G. rapæ*, giving a decided suggestion of sweetbriar. Dr. Longstaff, who also finds great individual differences in intensity, considers the scent to be 'like that of *G. brassicæ*, but stronger and more luscious.' I have tested the female, with negative results.

"*Belenois thysa*, Hopff., ♂, has a strong, distinct odour, which appears to me to be like that of roses. Dr. Longstaff notes it as a very sweet scent; in one case comparing it to that of *Scilla nutans*, in other cases to that of *Freesia*.

"The scent of *Belenois zochalia*, Boisd., ♂, is not as a rule very powerful. It seems to me to be of the sweetbriar order, including the scent of the flower as well as of the foliage. It was more distinct in a worn specimen than in two fresh ones examined on the same day. Dr. Longstaff found a 'faint flowery scent like that of *G. brassicæ*' in the single individual he tested.

"*Pinacopteryx charina*, Boisd., ♂, has a perfume like a whiff of mignonette, seldom strong and often absent. Of nine males tested at different times by Dr. Longstaff, only one had a decided odour, which he records simply as 'flowery.'

"In *Pinacopteryx pigea*, Boisd., ♂, the scent is distinct, in some cases strong. It appears to me to resemble honeysuckle —a comparison in which Dr. Longstaff concurs. One of my specimens had an odour more suggestive of *Philadelphus*, and the scent of one of Dr. Longstaff's was noted by him as 'sweet and spicy.' The female was found by me to be odourless.

"The scent of *Mylothris agathina*, Cram., ♂, though varying somewhat in intensity in different individuals, is generally one of the strongest and most distinct in the whole range of Pierine odours so far as I am acquainted with them. To both Dr. Longstaff and myself it appears to be exactly that of sweetbriar. It is a pleasant and refreshing perfume, and is easily perceptible even when the butterfly is held in the hand unrubbed. The female was always found by me to be scentless; but one tested, after death, by Dr. Longstaff, had a strong 'mousy' odour, like henbane; an observation which I can confirm.

"The scent of *Mylothris rüppellii*, ♂, is in the opinion of both of us indistinguishable from that of *M. agathina*, ♂. A female specimen, when dead, was noted by Dr. Longstaff as having a slight 'black-beetle' odour; this, however, I failed to detect.

"In nearly all the specimens of *Mylothris trimenia*, Butl., ♂, which I was able to test, there was a strong, pleasant, characteristic odour, not easily described, and quite distinct from that of *M. agathina*. It contains a predominating sweet flowery constituent, perhaps a little like that of *Pinacopteryx pigea*, but reminding me rather of sweet-pea than of

honeysuckle. Besides this there seems to be an element of sweetbriar, but without the characteristic roughness—recalling rather the rose than the foliage of that plant. The scent also conveys a suspicion of orange or lemon-peel—nearer orange. The scent of nearly all Dr. Longstaff's specimens was noted by him as being like that of clover; in one, however, it was thought to be like that of *G. rapæ*. The female was found by me to be scentless.

"Only one specimen of *Glutophrissa saba*, Fabr., ♂, was tested; no odour was detected.

"A few specimens of *Synchloë hellica*, Linn., ♂, examined by me gave a distinct, though not very strong scent like that of gorse. The females were odourless, as indeed were many of the males. A male tested by Dr. Longstaff was recorded by him as having 'a very slight, heavy, flowery odour.'

"It is worthy of notice that although in all these species the intensity of the scent varies, sometimes greatly, as between different individuals, this variation bears no definite relation to the condition as to freshness of the specimen examined. I have no clear evidence that the scent is discharged more copiously during courtship; though this may quite possibly be the case. The perfume may persist for some little while after the death of the insect, but has generally become much impaired or has disappeared altogether by the time that the butterfly is stiff. So long as stiffening has not taken place, the scent is more easily detected and estimated at home than in the field. Rubbing the wings is in most cases unnecessary.

"I exhibit this evening spirit extracts of the wings of *Mylothris agathina* and *Belenois severina*, which will be found easily distinguishable by the sense of smell from each other and from the pure spirit. On a future occasion I hope to say something of the odours as they exist in other groups of butterflies."

A discussion on the presence and use of scents in various orders of insects followed, in which the President, Professor Poulton, Col. C. T. Bingham, and other Fellows joined.

Papers.

Mr. P. I. Lathy, F.Z.S., communicated "A Contribution towards the knowledge of African Rhopalocera."

Col. C. T. Bingham communicated a paper entitled "A New Species of the Hymenopterous genus *Megalyra*, Westwood, by J. Chester Bradley, Ithaca, N.Y., U.S.A."

Wednesday, November 15th, 1905.

Mr. F. Merrifield, President, in the Chair.

Obituary.

The decease was announced of Captain Frederick Wollaston Hutton, F.R.S., Director of the Canterbury Museum, Christchurch, New Zealand.

Election of Fellows.

Mr. W. R. Dewar, Government Entomologist, Orange River Colony; Mr. William George Sheldon, of Youlgreave, South Croydon; and Mr. Francis C. Woodbridge, of Northcroft, Cornwall Road, Uxbridge, were elected Fellows of the Society.

Nomination of Officers and Council for 1906.

Mr. H. Rowland-Brown, one of the Secretaries, announced that the Council had nominated the following Fellows to act as Officers for 1906:—President, Mr. F. Merrifield; Treasurer, Mr. A. H. Jones; Secretaries, Mr. H. Rowland-Brown, M.A., and Commander J. J. Walker, M.A., R.N.; Librarian, Mr. G. C. Champion, F.Z.S.; and as other Members of the Council, Mr. G. J. Arrow, Mr. A. J. Chitty, M.A., Mr. J. E. Collin, Dr. F. A. Dixey, M.A., M.D., Mr. H. Goss, F.L.S., Mr. W. J. Kaye, Mr. W. J. Lucas, B.A.,

Professor E. B. Poulton, D.Sc., M.A., F.R.S., Mr. L. B. Prout, Mr. E. Saunders, F.R.S., F.L.S., Mr. R. S. Standen, F.L.S., and Mr. C. O. Waterhouse.

Exhibitions.

Mr. G. J. Arrow exhibited a flower-frequenting beetle from the Transvaal, illustrating a remarkable device for the cross-fertilization of flowers, one of the front feet being tightly clasped by the curiously-formed pollinia of an *Asclepias*. Mr. Arrow remarked that he had seen no similar instance amongst Coleoptera, although in some insects the phenomenon was no doubt familiar to those who had had opportunities of observation in the countries affected by these plants. Professor E. B. Poulton stated that he had often found such pollinia attached to Hymenoptera.

Mr. W. J. Kaye showed a remarkable specimen of *Agrotis tritici*, bearing a close resemblance to *A. agathina*. It had been taken this year at Oxshott flying over heather in company with *agathina*, and was a good example of syncryptic resemblance brought about by the common habit of resting on heather. The specimen agreed with *agathina* in ground colour; in the pale costa; in the distinct dark wedge-shaped marks near the outer margin; and in the distribution of the stigmata. These characteristics are simply a strong development of characters which recur in the species, and it was the simultaneous development of all of them which gave the insect its strong likeness to *A. agathina*.

Mr. W. J. Lucas exhibited a specimen of *Forficula auricularia* taken by Mr. R. A. R. Priske at Deal in September 1905, having the left cercus normal, while the right was that of var. *forcipata*.

Dr. F. A. Dixey exhibited some specimens of African Pierinæ, and remarked upon them as follows:—

"The recent visit paid by Dr. Longstaff and myself to South Africa fell, so far as Natal and Rhodesia are concerned, well within the limits of the dry season. I have brought here for exhibition representative specimens of four species of *Teracolus*, viz., *T. annæ*, Wallgrn., *T. omphale*, Godt.,

T. achine, Cram., and *T. auxo*, Luc., all taken by us in those localities during August and September of the present year. Wherever possible, I have included the male and female of both the Natal and the Rhodesian form of each species exhibited. I also show, for comparison, male and female specimens of the same four species, taken in the same localities as our own, but during the wet season of the year instead of the dry. As none of the specimens exhibited was selected for the purpose of proving any point, but each is a fair representative of the category to which it belongs, the whole assemblage may be taken as an illustration of the general correspondence of the variation of these particular forms with the meteorological conditions prevailing at the time of year when they are respectively found. So different in appearance are the 'wet season' and 'dry season' phases of these butterflies, that, as has also happened in many other cases, they have been described under different names, and are even now pretty generally ranked as separate species. It may therefore not be amiss to recall the fact that in the case of three out of the four it has been absolutely proved by Mr. G. A. K. Marshall, who has bred them through, that the two seasonal forms are conspecific (see Trans. Ent. Soc. Lond., 1902, pp. 200, 209–212).

"There remain two further points that seem worthy of note. One is that, as will be easily evident on inspection, our Natal forms, though distinctly of the 'dry season' type, are appreciably less extreme in that direction than are our Rhodesian representatives of the same species. This corresponds with the much more markedly dry meteorological conditions that we found prevailing in the latter locality. The other point is that, even in cases where the wet-season males of two species, such as *T. omphale* and *T. achine*, are quite unlike one another, the resemblance between the dry-season males of the same two species may be so close that in the field they can only be distinguished with difficulty."

Colonel J. W. Yerbury said that in his opinion the term "seasonal" when applied to developments of this kind was misleading. The variation of the forms seemed to depend not upon fixed seasonal conditions, wet or dry weather, but

upon the amount of moisture and light to which the species were subjected, probably in the pupal stage.

Professor E. B. Poulton understood that the term "season" as used in this connection, referred to the climatic conditions which prevailed at the time. He considered that "wet form" and "dry form" were more accurate expressions than "wet season form" and "dry season form."

Mr. Selwyn Image exhibited a ♂ specimen of *Tortrix pronubana*, Hb., taken by Mr. Harold Cooper in his drawing-room at Eastbourne, either at the end of September or the beginning of October last, and sent to him on October 12th. The insect, which is new to his British list, is placed by Staudinger in his Catalogue next to *T. viridana*, L., and is reported by him from South Europe, North-West Africa, and Asia Minor. It is about the size of *T. bergmanniana*, L., the upper wings of a soft purplish-brown, the lower a rich orange terminally suffused with fuscous.

Commander Walker said that the capture this year of another specimen of *pronubana* had been reported in the Worthing district, and suggested that there might have been an immigration.

Mr. Edward Harris exhibited a long series of *Hemerophila abruptaria* bred for the purpose of determining the effects of heredity through successive generations. He said:—

"On November 2nd last year I showed a small brood of *abruptaria* including a few melanic forms (Proc. 1904, p. lxxii). The two pupæ that went over emerged April 4th and 5th this year, one a light male and the other a light female. Both are remarkably larger than those that emerged in 1904 from the same brood. From the brood of larvæ, also mentioned, 57 pupated and the following imagines emerged between March 24th and May 6th, 1905:—

"12 dark males, 16 dark females, 5 light males, and 6 light females.

"The remaining 18 did not break through their silken cocoons, but upon examination I think they would have been 5 dark males, 6 dark females, 3 light males, and 4 light females.

"From the above moths I paired dark male with dark female, light male with light female, dark male with light female, and

light male with dark female, of which the following is the result:—

"The dark male and dark female have thrown all dark, 34 males and 34 females; 9 pupæ have not changed.

"The light male and light female have thrown all light, 9 males and 9 females; 3 pupæ have not changed.

"The dark male and light female have thrown 8 dark males and 16 dark females, 3 light males and 3 light females; one pupa has not changed.

"The light male and dark female have thrown 19 dark males and 15 dark females, 7 light males and 8 light females; 13 pupæ have not changed.

"The last moth emerged November 6th."

Paper.

Commander J. J. Walker communicated a paper entitled "Hymenoptera Aculeata collected in Algeria by the Rev. A. E. Eaton, M.A., and the Rev. F. D. Morice, M.A.; Part ii, Diploptera," by Edward Saunders, F.R.S., F.L.S.

Wednesday, December 6th, 1905.

Mr. F. Merrifield, President, in the Chair.

Election of an Honorary Fellow.

Doctor O. M. Reuter, of Helsingfors, Grand Duchy of Finland, was elected an Honorary Fellow of the Society.

Election of Fellows.

Mr. Charles William Mally, M.Sc., Associate of the Society of Economic Entomology of Washington, U.S.A., Government Entomologist for the Eastern Province of the Cape Colony, and Mr. Harold Powell, of Rue Mireille, Hyères, France, were elected Fellows of the Society.

Nomination of Officers and Council for 1906.

Mr. H. Rowland-Brown, one of the Secretaries, again read the list of Fellows nominated to act as Officers and as other Members of the Council for 1906.

Auditors.

The President announced that the following Fellows had been appointed Auditors of the Society's Accounts for the current year. Mr. R. Adkin, Dr. T. A. Chapman, Mr. R. W. Lloyd, Mr. L. B. Prout, Mr. H. Rowland-Brown, and Mr. R. South.

Exhibitions.

Dr. K. Jordan exhibited a series of varieties of the Mediterranean *Carabus morbillosus*, showing all intergradations from the ordinary *morbillosus* with broad prothorax and costate and catenulate elytra to the Moroccan *aumonti* which has a narrow thorax and smooth elytra. It is one of the most striking cases of geographical variability.

Mr. H. St. J. Donisthorpe showed specimens of *Ptinus pusillus*, Sturm, recently discovered in a corn factor's shop at Edmonton. This species, which is common in France and Germany, has not been recorded hitherto in Britain.

Mr. A. J. Chitty exhibited (1) a hermaphrodite Proctotrupid belonging to the *Spilomicrinæ*, Aspn., probably one of the *Ceraphroninæ*—a hermaphrodite of *Diapria verticillata* is mentioned in Marshall's Catalogue, but the specimen exhibited appeared to belong to the other subfamily of the *Diapriidæ*; (2) a sand-wasp without wings taken by Mr. Poole, running on a beech trunk, and probably *Didineis lunicornis*, Fab.; (3) the ♂ specimen of *Apion semivittatum*, Gyll. (*germari*, Walt.), taken many years ago by Mr. Walton near the Tivoli Gardens, Margate, together with a ♀ specimen of the same species discovered while sweeping long grass near the Chequers Inn, Deal, on September 26th, 1904, on which occasion also Mr. Tomlin had made a similar capture.

Mr. F. B. Jennings exhibited (1) a ♂ and ♀ example of the Dipteron *Helophilus transfugus*, L., taken from thistle-heads in the marshes at Edmonton last July, and (2) a

specimen of *Stenopteryx hirundinis*, a parasite on swallows and martins, found on Box Hill, Surrey, in August.

Mr. G. T. Porritt brought for exhibition specimens of *Odontopera bidentata* ab. *nigra*, and stated that the form was rapidly increasing in the Wakefield district of South Yorkshire. Apparently, in a few more years it would oust the ordinary form prevailing there completely.

Dr. F. A. Dixey exhibited examples of five species of South African Pierinæ, in further illustration of geographical and seasonal variation. The exhibit, which was supplementary to that shown on November 15, comprised specimens of *Eronia cleodora*, Hübn., from East London and Natal, *Belenois severina*, Cram., from Natal and Rhodesia, *Teracolus speciosus*, Wallgrn., *Pinacopteryx pigea*, Boisd., and *P. charina*, Boisd., all from Natal. In every instance the contrast between forms captured during the dry months of the year and specimens of the same species taken in the same localities during the rains was very distinct. Two points were mentioned as being especially worthy of note. The first was the extremely "dry" character of the examples of *E. cleodora* taken both in August and September at East London as compared with those taken in August at Durban. The difference was so well marked and so constant as to suggest the existence in the region south-west of Natal of a distinct local race. The second point was the appearance presented by the "dry season" examples of *B. severina* from Rhodesia, in which the dark veining of the under-side of the hind-wing tended to become faint or to disappear; this disappearance of the veining being in Natal specimens a mark of the "wet season" phase of the species, while the "dry season" forms from Durban were in nearly every instance heavily veined beneath. Dr. Dixey further remarked that the seasonal relations of the various forms of *B. severina* had always been somewhat of a puzzle, and the difficulty seemed to be increased rather than diminished by a consideration of the present specimens. More data were needed in regard both to this species and to the nearly-allied *B. mesentina*, before any satisfactory conclusion could be reached. With regard to the exhibit as a whole, he was well aware that by selecting instances it was often possible to make

out a better case than the facts really warranted. He had, however, done his best, in arranging the present series, to choose not extreme, but average representatives of each form of the various species exhibited.

Mr. O. E. Janson exhibited a ♂ and ♀ specimen of *Ornithoptera chimæra*, Rothschild, and some remarkable species of *Delias* collected recently by Mr. A. S. Meek in the mountain region of British New Guinea. With regard to the former he observed that it was the only known *Papilio* with a ringed body, while the strongly pubescent body of the ♀ was also an exception to the general rule.

Commander J. J. Walker, on behalf of Mr. A. M. Lea, Government Entomologist of Tasmania, showed a specimen of the Buprestid beetle *Cyria imperialis*, Don., having, in addition to the normal fore-leg on the left side, two supplementary fore-legs originating from separate coxæ. One of them was equally well-developed with the normal leg; the other somewhat shorter, owing to abbreviation of the tibia and tarsus, all the parts in these legs being present.

Mr. G. C. Champion exhibited living ♂ and ♀ examples of *Tetropium crawshayi*, Sharp, bred by the Rev. G. A. Crawshay from eggs deposited in July last in the bark of larches at Leighton Buzzard.

Mr. E. R. Bankes showed (1) the specimen, unique as British, of *Depressaria emeritella*, Stn., on which the species was added to the British List by Stainton (Sup. Cat. Tin. Pter. p. 4) in 1851; (2) a specimen of *Cerostoma asperella*, L., captured by Mrs. Hutchinson near Leominster, on September 21st, 1881, and only taken, as regards Britain, in Dorset (not since 1831), and Herefordshire very rarely; and (3) various specimens labelled by Haworth himself, showing the method of explaining his identification of the species, noticed by him in his "Lepidoptera Britannica," published 1803–1828. The exhibitor hoped that a more general acquaintance with these labels would lead to the rescue, from oblivion or destruction, of other of these valuable Haworthian types and identifications.

Mr. A. Bacot exhibited a series of *Tryphæna comes* representing three generations, bred by Messrs. J. E. Gardner,

A. Harrison, T. H. Hamling, L. W. Newman, L. B. Prout, the Rev. G. H. Raynor, and himself.

PARENTS.—The parents were selected from moths reared from wild larvæ collected at Cluny, Aberdeenshire, by Mr. James Duncan in the spring of 1904. And these, together with the remainder of the moths reared from these larvæ, were also exhibited.

From the wild larvæ three melanic specimens alone were reared out of about fifty; these were all males. Among the non-melanic specimens one was of a very dark slate colour, all the remainder being paler, comprising very varied shades from dull grey through ochreous and bright red to a deeper almost chestnut red.

Only the bright red and melanic forms, and the dark slate-coloured specimen above referred to were used as parents. The red forms, save for the purposes of a very careful classification, are uniform, but the melanic specimens reared include a range from rusty red powdered with black scales to velvety black; there is, however, a quite definite line of demarcation between "red" and "melanic" forms, no doubt as to the correct position of any particular specimen having occurred.

In contradistinction to Mr. Prout's Forres race (Ent. Record, vol. xv, p. 217; vol. xvi, pp. 1–5) there is no trace of melanic suffusion on the hind-wings of any of the specimens of Cluny parentage.

The first generation took from the time of hatching in July 1904 until about the middle of January 1905 to complete their cycle; the second generation, December 1904 to April–May 1905, except those reared by the Rev. G. H. Raynor, which were allowed to develop more slowly, emerging in July and August 1905. The third generation, and last,* occupying from May to September 1905.

* Pairings between moths of the third generation were very difficult to obtain, and when obtained there were usually very few, if any, ova laid by the female. In two of the three instances in which fairly normal numbers were laid only three or four larvæ hatched, and these did not survive the first moult. The one exception, a pairing between moths of the B × C stock, resulted in a fair-sized brood of larvæ, but they were all weakly and died off before their fourth moult.

In this connection it must be remembered that the B × C stock was less pure than the others as it resulted from a cross between two different stocks in the first generation, whereas all the other stocks arose from a single pair of the moths reared from the wild larvæ.

During late autumn, winter, and early spring, those reared by myself were fed for the most part on cabbage and brussels sprouts with some admixture of dock. During the summer the larvæ were supplied with various low plants as well as sallow and willow, but no cabbage.

The imaginal life of the species is long with healthy specimens, varying according to conditions of temperature and moisture from three weeks to a month in the summer, and considerably longer during the winter—of course within doors—the females being longer lived as a rule than the males.

Pairing in my experience does not take place in less than a week from date of emergence under the most favourable circumstances (warm moist summer weather) with the males, and from two to three weeks in the case of the females. In one or two instances the early death of the specimen selected for male parent necessitated the careful choice of a second as nearly identical with the first as possible, in one case that of Brood C 2, a third male had to be introduced, fortunately owing to the peculiarity of the pairing habit above referred to, and the fact that the replaced males became paralyzed or died within two or three days of emergence, I feel quite confident that only the one pairing took place.

The experiment was not made in the first place with a view to testing the Mendelian theory, but in order to ascertain the relative proportions of melanic to non-melanic forms, and the possible range of variation to be obtained from a single pair. Apart from the relative strength or weakness of the melanic strain the heredity from parents to offspring would seem to be very strict, and this result is quite in conformity with previous experiments conducted with the same species, and also with other Noctuid moths in which great diversity of forms can be obtained from a very restricted area. This purity of strain suggests how easily a series of local races developing into sub-species might be caused by isolating factors such as diverging habits, etc.

But the result is in contrast with experiments in rearing broods of *Malacosoma castrensis* when a very wide range of forms was obtained from a single batch of eggs or from a

pairing between a particular male and female. And Mr. Prout informs me that this is sometimes, though not as a rule, the case with the Geometrid stirps.

All the results of the second and third generations seem to be capable of Mendelian explanation *if* we call the melanic strain the Dominant and the red forms Recessives. For this purpose all the parents of the melanic broods of the second generation must be assumed to be Dominant Recessives, while the male parent of brood C 7 × C 7 (third generation—(melanic male paired with a red female) must be assumed to be a pure Dominant, as all the offspring were melanic. And again both the parents of brood C 9 × C 7 (third generation) must also have been Dominant Recessives. On the other hand, at least one of the parents of the remaining melanic broods of the third generation, broods C 9 × C 9 and C 7 × C 2, must have been for Mendelian purposes a pure Dominant.

The red parents throwing all red offspring will of course be Recessives. So far all is straightforward, but if we attempt to apply the principle backwards instead of forwards, we come to a serious difficulty in respect to the first generation, as the results do not tally with either the supposition that the male parent was "pure Dominant" or Dominant Recessive.

FIRST GENERATION

	ACTUAL RESULTS	CORRECT MENDELIAN PROPORTIONS
Brood B.	*Male* parent dark slate (non-melanic) *Female* Red (non-melanic)	If male D. R. × female R. Result should be 50% Melanic, 50% Red.
Result.	Most of the larvæ were lost owing to an accident but one slate-coloured specimen and one red one were bred. The "Red" specimen of this brood was the *male parent* of *Brood B × C.*	
Brood C.	Male Melanic. Female red.	Or if male D. D. × female R. Result should be 100% Melanic.
Result.	21 Melanic (=40%) 32 Red (=60%)	

SECOND GENERATION

	Male Melanic.	Female Melanic.	
Brood C 2.			Brood C. If both parents D. R. Result should be 75% Melanic, 25% Red.
Result.			
Bacot	60 Melanic	26 Red.	
Gardner	21 Melanic	5 Red.	
Prout	17 Melanic	5 Red.	
	98 = 73%	36 = 27%	

	ACTUAL RESULTS		CORRECT MENDELIAN PROPORTIONS
Brood C 7. *Result.*	Male Melanic.	Female Melanic.	Brood C 7. If both parents D. R. Result should be 75% Melanic, 25% Red.
	Bacot 50 Melanic	14 Red.	
	Newman 8 Melanic	1 Red.	
	Raynor 22 Melanic	4 Red.	
	80 = 81%	19 = 19%	
Brood C 9. *Result.*	Male Melanic.	Female Melanic.	Brood C 9. If both parents D. R. Result should be 75% Melanic, 25% Red.
	Bacot 19 Melanic	8 Red.	
	Prout 15 Melanic	8 Red.	
	34 = 68%	16 = 32%	
Brood C 3. *Result.*	Male Red.	Female Red.	Brood C 3. In agreement.
	Bacot 19 Red		
	Gardner 10 Red		
	29 = 100%		
Brood B × C. *Result.*	Male Red.	Female Red.	Brood B × C. In agreement.
	Bacot 131 Red		
	Gardner 77 Red		
	Raynor 48 Red		
	256 = 100%		

THIRD GENERATION

Brood C 7 × C 2. *Result.*	Male Melanic.	Female Melanic.	Brood C 7 × C 2. If one parent D. D. In agreement
	Bacot 24 Melanic		
	Harrison 21 Melanic		
	45 = 100%		
Brood C 9 × C 7. *Result.*	Male Melanic.	Female Melanic.	Brood C 7 × C 9. If both parents D. R. Result should be 75% Melanic, 25% Red.
	Prout 16 Melanic (=76%)	5 Red (=24%)	
Brood C 9 × C 9. *Result.*	Male Melanic.	Female Melanic.	Brood C 9 × C 9. If one parent D. D. In agreement
	Bacot 7 Melanic (=100%)		
Brood C 7 × C 7. *Result.*	Male Melanic.	Female Red.	Brood C 7 × C 7. If male parent D. D. In agreement.
	Harrison 15 Melanic		
	Hamling 2 Melanic		
	17 = 100%		
Brood (B × C) × (B × C) *Result.*	Male Red.	Female Red.	Brood (B × C) × (B × C). In agreement.
	Bacot 20 Red = 100%		
Brood C 3 × C 3. *Result.*	Male Red.	Female Red.	Brood (C 3 × C 3). In agreement.
	Bacot 6 Red = 100%		

Mr. R. Shelford exhibited the larvæ of *Collyris emarginatus*, Dej., and of *Mormolyce*, and read the following notes:—"In 'Mededeelingen uit 'Slands Plantentuin,' xliv, 1901, p. 113, Dr. J. C. Koningsberger, of the Buitenzorg Zoological Museum, publishes a brief notice of the larva of the Cicindelid beetle, *Collyris emarginatus*, Dej., burrowing in the twigs of coffee-shrubs. I noticed a preparation illustrating this remarkable habit for a Cicindelid larva in the museum at Buitenzorg in March of this year, but it was inside a locked case, and as Dr. Koningsberger was on leave in Europe, I was unable to make a close examination of the larva and its burrow. In answer to a request for material and information on the species, Dr. Koningsberger has kindly sent me the specimens which I now have pleasure in exhibiting to this Society. Dr. Koningsberger tells me that the larva feeds on the ants and aphides that crawl over the coffee-twigs; pupation takes place in the burrow; oviposition has not been witnessed, nor have any but full-grown, or nearly full-grown, larvæ been found, so that it is not known if the burrow is enlarged to allow of the increase in size of its occupant, or if it is originally made large enough to accommodate the larva throughout its life. A figure of the larva is published in the above-mentioned work (Fig. 59), but it is evidently only a copy of the figure of a Cicindelid larva in Packard's "Guide to the Study of Insects," and is quite inadequate. The *Collyris* larva differs from the larvæ of the British *Cicindelæ* by its flattened femora, small size and more cylindrical body; the tubercles of the fifth abdominal segment bear a comb of three or four short teeth instead of one long hook, and these combs are better adapted for getting a purchase on the walls of a wooden burrow than would be the long hooks of some sand-burrowing *Cicindelæ*. I intend to make a careful and critical study of the mouth-parts; as it is certainly unusual to find a predaceous larva with mouth-parts qualified to excavate burrows in wood. The mouth of the burrow is countersunk, and Mr. A. H. Hamm informs me that the same feature can be seen in the sand-burrows of the British *Cicindelæ*. I have no doubt but that the lower surface of the head of the *Collyris* larva fills completely the orifice of the burrow when the insect is awaiting

its prey, the jaws projecting into the countersunk area. The adult *Collyris emarginatus* is arboreal in its habits, is remarkably fleet, and readily takes to wing; in Borneo, as I have shown (P. Z. S., 1902, vol. ii, p. 264), it is mimicked by a flower-haunting fly of the genus *Sepedon*; it feeds on small insects, and the statement in the Deutsche Entomol. Zeitschr. 1905, p. 172, that it is herbivorous is erroneous, and is due to a misunderstanding.

"I have also for exhibition some larvæ and pupæ of *Mormolyce*, together with a specimen of a *Polyporus* fungus split open to show the lenticular chamber excavated by the larva. The adults, male and female, are usually found resting on the under surface of these fungi, or on the tree trunk from which the fungus projects; oviposition has not been witnessed, but I believe that only one egg (or at most two) is laid at a time, for I have not been able to find more than one larva in the chamber,* though on one occasion I took a newly-emerged adult from the surface of a fungus in which was hollowed out a chamber containing one larva. Access to the larval chamber is attained by an orifice so small that it is surprising that the newly-emerged beetle can squeeze through it to the exterior, this orifice is situated on the upper surface of the fungus. It will be seen that there are no features of particular interest about the external appearance either of larva or pupa; these pupæ do not show the elongation of the head and thorax characteristic of the adult. Overdyk, who gives a bionomical account of this species in Ned. Ent. Vereen, vol. i, 1857, states that the larvæ are predaceous. The larva and the pupa have been figured and described by Verhuell (Ann. des Sciences Naturelles, 1847.)"

Professor E. B. Poulton communicated the following note by Mr. A. H. Hamm, of the Hope Department, Oxford University Museum. The observations extend and support those recorded by him in "Proc. Ent. Soc. Lond., 1904," p. lxxv.

"The following observations made at Oxford during the

* The short note on this species which I published in British Assoc. Reports, 1901, was largely based on information supplied to me by a native collector, and this information, I regret to say, was proved afterwards by my own observations to be inaccurate.

present year, tend to confirm the opinion that *Pieris rapæ* chooses for prolonged rest, a surface upon which it will be concealed. Although only five individuals were observed, these had, without exception, selected a position of considerable protective value. The first butterfly was seen near Cowley Marsh on May 7th, at about 4 p.m. The afternoon was dull and cloudy, and the insect was resting in a semi-torpid state among the flowers of the white dead-nettle (*Lamium album*) in a hedge. A week later, on May 13th, between 4 and 5 p.m., when searching the same hedgerow, another individual was found in an almost identical position. Hanging in the midst of the largish white flowers of the Labiate the butterflies were beautifully concealed, and were indeed only found because the plants were carefully examined for other insects.

"On August 17th, between 7 and 8 p.m., when looking for larvæ on the hedge bordering my garden, near the Cowley Road, I found two *rapæ* within a few inches of each other. Both were resting on the silvery under-sides of bramble leaves. In both cases, however, the leaves were twisted and the lower surface had become the upper. Again, on August 20th, in a lane leading to Temple Cowley, at 5.30 p.m., I watched an individual flying slowly along a hedgerow, every now and then resting for a few seconds. Finally, after many attempts, it settled down, apparently for the night, and on going to look more closely, I found that it also had chosen the under-side of a bramble leaf. Although not quite so well concealed as among the white flowers, these last examples blended wonderfully well with their environment.

"After some years of close observation of the resting habits of insects in general, I feel convinced that they possess an inherent tendency to select an environment that aids in concealment; and as the various species differ in appearance so do they select diversified situations suited in each case to the particular requirement of the insect."

A discussion followed, Mr. H. J. Elwes expressing his conviction that the use of surroundings by insects, and Lepidoptera especially, for protective purposes simply, was still an open question. Colonel J. W. Yerbury mentioned the case

of *Euchloë euphenoides* and *Zegris eupheme* roosting at Granada on plants of *Biscutella*, the appearance of the insects at rest closely approximating to that of the flower heads. Mr. H. Rowland-Brown observed that he had noted a similar resemblance between a specimen of *Pieris napi* and the flower of *Leucojum* on which it rested for the night. Mr. G. C. Champion said that he had noticed specimens of *Gonepteryx rhamni* seek the under-sides of bramble leaves.

Dr. T. A. Chapman said that Col. Yerbury's observation on *Euchloë euphenoides* resting on the flowers of *Biscutella* is one that may be often made in the South of France, and few English Entomologists have not observed *E. cardamines* at rest on *Alliaria* flowers, or on some Umbellifer that roughly resembles it. These facts seem to give the clue to how the practice of these *Crucifer*-feeding Pierids of affecting objects of their own colour for resting arose. In so many of these cases, the food-plant is in flower when the butterfly is on the wing, and in the case of *Euchloë* the flower head is the place selected for egg-laying. It comes about, then, that the butterflies frequent the flowers of their food-plant, both for the honey they afford and for egg-laying. That it would often happen, therefore, to be the resting-place of the butterfly when overtaken by a sudden failure of sunshine is obvious. Nothing further is needed as a basis for natural selection to gradually accumulate in association, the characters of resting on the flower of the food-plant, and assimilation to it in colour.

A butterfly, searching for a flower head to rest on, will act of course in the same way as one searching for it for any other purpose, viz., it will discover at a distance an object of the desired colour, and will be able to verify what it really is, only after a close approach. If it wants to suck honey, or to lay an egg, such verification is imperative, and all collectors are familiar with butterflies closely approaching a piece of coloured paper, a dead leaf or other object, and only when quite close discovering that it is not the desired mate, or flower, and at once departing. But if a resting place for the night is desired, such verification is not absolutely essential, and a place *must* be chosen, so that if after several tries a near approach only produces disappointment, an occasion at

length occurs, when advancing evening makes it necessary to appropriate the resting place without the final verification. Thus a *Pieris* or a *Euchloë* will learn to accept as a resting place any white object, even if it be not a flower head of a Crucifer.

But if it be objected that cabbage and turnip, the usual foods of our "cabbage" butterflies, have yellow flowers, the reply is that these foods, for these butterflies, are entirely human inventions, and therefore comparatively modern. Their natural foods have chiefly white flowers, such as, *Nasturtium*, *Arabis*, *Draba*, *Cochlearia*, *Thlaspi*, *Lepidium*, *Turritis*, *Alliaria*, and many others, the two last mentioned being the favourite foods of *E. cardamines*. It may also be suggested that the frequently very yellow under-sides of our common "cabbages" are due to the yellow flowers of our cultivated Brassicas, and of such wild Crucifers as *Raphanus sinapis*, and *Barbarea*.

The President, Mr. A. J. Chitty, Dr. F. A. Dixey, Professor E. B. Poulton, and other Fellows offered observations on the subject.

Papers.

Mr. William John Lucas exhibited diagrams of the instars, and also of the mouth parts of the imago, to illustrate the paper read by him "On the Emergence of *Myrmeleon formicarius*."

Mr. Martin Jacoby communicated a paper entitled "Descriptions of New Species of African *Halticinæ* and *Galerucinæ*."

Mr. Claude Morley communicated a paper "On the Ichneumonidous group *Tryphonides schizodonti*, Holmgr., with Descriptions of New Species."

ANNUAL MEETING.

January 17th, 1906.

Mr. F. Merrifield, President, in the Chair.

Mr. R. Wylie Lloyd, one of the Auditors, read the Treasurer's Balance Sheet, showing a balance of £50 3*s.* 5*d.* in the Society's favour.

Mr. H. Rowland-Brown, one of the Secretaries, read the following

Report of the Council.

During the Session 1905–1906 eleven Fellows have died, viz. two Honorary Fellows, M. Henri de Saussure and Dr. Alpheus S. Packard, and nine Fellows, Mr. Alfred Beaumont, Mr. George Bowdler Buckton, F.R.S., M. A. Prudhomme de Borre, Mr. John William Douglas, Lieut.-Colonel L. H. Loyd Irby, Captain F. Wollaston Hutton, F.R.S., Mr. Alexander Fry, Mr. H. W. Peal, and the Rev. Francis Augustus Walker, D.D.; seven Fellows have resigned, or have been struck off the list, and twenty-three new Fellows have been elected.

The number of Fellows deceased is, happily, not above the average; nor is the number of those who have resigned, or for other causes have been removed from the list. The number of Fellows elected, however, shows a considerable falling off from last year, though with candidates nominated and still to be elected it compares favourably with most previous years. The Council, however, are of opinion that the number might still be considerably augmented if Fellows would bring somewhat more energetically to the knowledge of their entomological friends the advantages of Fellowship of the Society.

At present the Society consists of twelve Honorary Fellows, and five hundred and four Life and Subscribing Fellows, making a total of five hundred and sixteen. These figures show that, for the first time in the history of the Society, the number of ordinary Fellows has reached five hundred, while the total fellowship also surpasses that of any previous year.

The Transactions for the year 1905 form a volume of four

hundred and thirty-eight pages, containing twenty-four Memoirs, contributed by the following authors: Mr. Nelson Annandale, Professor Christopher Aurivillius, Mr. George Bethune-Baker, Mr. Horace A. Byatt (with a note by Professor E. B. Poulton), Mr. J. Chester Bradley, Mr. George C. Champion and Dr. Thomas A. Chapman (with description by Professor O. M. Reuter), Dr. T. A. Chapman (three papers), Mr. John Alexander Dell, Mr. W. L. Distant, Mr. Herbert Druce and Mr. Hamilton Druce, Mr. F. DuCane Godman, Sir George F. Hampson, Bart., Mr. John C. W. Kershaw (two papers), Mr. G. W. Kirkaldy, Mr. Arthur M. Lea, Dr. George B. Longstaff, Mr. E. G. B. Meade-Waldo, Mr. E. Meyrick, Mr. Claude Morley, Mr. Edward Saunders, and Dr. David Sharp and Mr. F. Gilbert Smith.

Of these twenty-four papers no less than fourteen relate to Lepidoptera, three to Rhynchota, three to Hymenoptera, two to Coleoptera, and one to Diptera, while Mr. Champion and Dr. T. A. Chapman's paper, "Another Entomological Excursion to Spain," deals with Coleoptera, Hemiptera-Heteroptera, and Lepidoptera.

The Memoirs above referred to are illustrated by nineteen plates, including two maps, of which eight are coloured. The entire cost of Plates XVIII and XIX has been defrayed by Mr. E. Meade-Waldo, and of Plate X by Mr. F. DuCane Godman. Dr. T. A. Chapman has given the whole cost of Plate VIII, and half the cost of Plates II, III, IV, V, VI, and XII, and Professor E. B. Poulton half the cost of Plate XIV. Blocks inserted in the text of the Transactions and the Proceedings have also been given by Dr. G. B. Longstaff, Dr. T. A. Chapman, and Mr. H. Rowland-Brown. The volume of the Proceedings, consisting of about eighty pages in all, has been well kept up, thanks to the increased number of interesting exhibitions made by Fellows, and the notes read by them at the meetings, which also show a satisfactory average of attendances.

During the past year eighteen volumes—in addition to one hundred and eighty-seven periodicals, pamphlets, and reprints —have been added to the Society's Library, the increased use of which is demonstrated by the fact that, according to the

Assistant Librarian's Report, two hundred and eight volumes have been taken out by Fellows during the year, and the number of Fellows using the Library has largely increased. There have also been placed in the Library, under the gift of the Representatives of the late Mr. Robert McLachlan, F.R.S., not included in the aforesaid donations and purchases, two hundred and ninety-two volumes and pamphlets, to which a distinguishing mark is affixed in the list of additions. During this year, also, it has been arranged that the Library shall be open daily from 9 a.m. to 6 p.m., except on Saturdays, when the hours are from 9 a.m. to 2 p.m.

The Treasurer reports that, after carrying forward to 1906 the sum of £8 8*s.* for subscriptions paid in advance in 1905, and investing £47 5*s.* for three Life Compositions received during the year, making the total sum so invested £857 10*s.* 7*d.*, there remains a genuine cash balance in the Society's favour of £50 3*s.* 5*d.*

Arrangements have been made during the year for the sale of back numbers of the Transactions to Fellows and non-Fellows at a considerable reduction, and the report of the sales thus effected, and for more recent volumes, shows a satisfactory result. On the whole, therefore, we have to report that our financial position is well established, and Fellows may again be congratulated on the flourishing condition of the Society.

Entomological Society of London,
11, Chandos Street, Cavendish Square, W.
17*th January*, 1906.

The Secretaries not having received any notice proposing to substitute other names for those contained in the list prepared by the Council, the following Fellows constitute the Council for 1906–1907 :—Gilbert J. Arrow; George C. Champion, F.Z.S.; Arthur John Chitty, M.A.; James E. Collin; Dr. Frederick Augustus Dixey, M.A., M.D.; Herbert Goss, F.L.S.; Arthur Hugh Jones; William James Kaye; William John Lucas, B.A.; Frederic Merrifield; Professor Edward B. Poulton, D.Sc., M.A., F.R.S.; Louis Beethoven

Prout; Henry Rowland-Brown, M.A.; Edward Saunders, F.R.S., F.L.S.; Richard S. Standen, F.L.S.; Commander James J. Walker, M.A., R.N., F.L.S.; Charles O. Waterhouse.

The following are also re-elected as officers:—President Frederic Merrifield; Treasurer, Albert Hugh Jones; Secretaries, Henry Rowland-Brown, M.A., and James J. Walker, M.A., R.N., F.L.S.; Librarian, George C. Champion, F.Z.S.

The Balance Sheet and Report having been adopted, Mr. F. Merrifield, the President, delivered an Address. A vote of thanks to the President for his Address, and for his services as President during the past year, together with those of the other officers, proposed by Professor Meldola, and seconded by Mr. Charles O. Waterhouse, was carried unanimously. Mr. H. Rowland-Brown, Commander J. J. Walker, and Mr. A. H. Jones replied.

ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1905.

Receipts.	£	s.	d.
Balance in hand, 1st Jan., 1905, and at Bankers' ...	18	15	5
Subscriptions for 1905 ...	392	14	0
Arrears	31	10	0
Admission Fees	29	8	0
Donations	3	5	9
Sales of Transactions ...	141	14	4
Interest on Investments:—			
Consols £19 17 1			
Westwood Bequest 6 16 6			
———	26	13	7
Subscriptions in Advance	8	8	0
Life Compositions	47	5	0
	£702	14	1

Payments.	£	s.	d.
Printing Transactions, etc.	242	13	2
Plates, etc.	105	5	4
Rent and Office Expenses	204	16	6
Books and Binding	44	2	8
Investment in Consols ...	47	5	0
Subscriptions in Advance, per contra carried to 1906	8	8	0
Balance in hand and at Bankers'	50	3	5
	£702	14	1

In account with the late Robert McLachlan, Esq., *Treasurer*.

Balance at Bankers' due to his Representatives brought forward from last year	£100	0	0	Paid by cheque to his Representatives	£100	0	0

Testimonial to the late Mr. W. R. Hall, *Resident Librarian*.

Further subscriptions received	£1	1	0	Paid by cheque to his Representatives	£1	1	0

Assets.	£	s.	d.
Subscriptions in arrear considered good (say) ...	50	0	0
Cost of £857 10*s.* 7*d.* Consols	839	8	0
Cost of £239 12*s.* 4*d.* Birmingham 3 per cent.	250	0	0
Balance in hand	50	3	5

No Ascertained Liabilities.

A. Hugh Jones,
Treasurer.

Additional Assets.

Contents of Library, including books from the library of the late Mr. McLachlan and unsold Publications.

T. A. Chapman.
R. W. Lloyd.
Robert Adkin.
Richard South.
H. Rowland-Brown.

THE PRESIDENT'S ADDRESS.

Ladies and Gentlemen,

The Report presented by the Council will have informed you of the prosperous state of the Society, and of the record it has during the past year established in the number of its Fellows. When one considers the vast number of species of insects, as compared with that of other classes of animals, their immense antiquity, the perfection they have reached in their physical equipment and in their instincts, their exhaustless variety of form and function, and the scope which, by their metamorphoses and in other ways, they afford for the solution of problems in which all biologists are interested, one can but expect that the Society will become more and more important, and that its members will continue to increase in number and, as far as indications appear, certainly with no deterioration in quality. The interest which draws its members together is one that is concerned with every part of the world. It is by a collation of the species and varieties which all the different parts of the world have to present that the science will be advanced, and from this point of view it is most satisfactory to note how largely the Society is constituted of Fellows resident abroad. In looking through the list of Fellows at the beginning of the year 1905, I found that these mounted up to more than one-fifth of the whole membership. Fifty-nine are resident in the British colonies and dependencies, and forty-six in foreign countries, of whom twelve are honorary members.

It is of interest to observe that about half the papers

contributed to the Transactions are of a biological character, and that many of the papers contain, besides the full descriptions of new species that are not only important but necessary, notes on their life histories and habits.

One of the most satisfactory features of the volumes published of late years is the amount of space given to the Proceedings. These record the periodical meetings of the Society, when, by means of the objects exhibited and of the observations that arise out of them and out of the papers read, many valuable facts are made known ; they frequently give rise to discussions of the greatest interest, and it is important that the advantage of these should not be lost to those who are not present at the meetings when they take place. It is of course impossible that your Honorary Secretaries, to whose skilled and assiduous labours we are so greatly indebted, should, unassisted, record with sufficient fulness all the salient points, but if those who bring forward objects for exhibition or take a part in the discussions will always render assistance by handing in notes of their contributions and of their observations, a satisfactory record can be preserved.

I hope it will not be out of place to express the satisfaction with which the Fellows of the Society have observed that some of their body, including two members of the Council, Professor Poulton and Dr. Dixey, were among those who took part in the expedition to South Africa of the British Association for the Advancement of Science. We congratulate them on their successful journey and their safe return in vigorous health, and I suppose we may say with even enhanced knowledge, from which our discussions have already derived benefit. I think I may add that our gratitude to them includes a prospective element, for we know that they have brought back much that is of great value in the way not only of specimens but of recorded observations, from which the future Transactions and Proceedings of the Entomological Society, of which they are such important members, cannot fail to derive much advantage.

I follow the time-honoured practice of referring to some of the Fellows of the Society whose loss during the past year we have to deplore.

Dr. Alpheus Spring Packard, an Honorary Fellow of this Society, died at Providence, Rhode Island, on the 14th February, 1905. He had held the position of Professor of Zoology and Geology in Brown University since 1878. No one did more than he to advance the knowledge of entomology in the United States. Among his voluminous contributions to science, the list of which fills nearly ten pages of the catalogues of the library of the Entomological Society, may be singled out for mention his monograph of the "Bombycine Moths," and the Text-book of Entomology published in 1898, in which he sums up the existing knowledge on the anatomy, physiology, embryology, and metamorphoses of insects, with full bibliographical lists; this work may be described as supplying a well-ordered guide to all that was known on the wide range of subjects of which it treats. Mr. Packard was well known for his advocacy of "neolamarckian" views.

The loss of Honorary Fellows during the past year includes another distinguished name, that of M. Henri F. de Saussure, of Geneva, eminent in many departments of life, grandson of one whose name was once famous throughout Europe as having made the ascent of Mont Blanc in 1787. Born in 1829, he wrote at an early period of life his monograph of the "Solitary Wasps," which he completed in Paris, where he became known to some of the distinguished men of science. In 1854 he was granted the diploma of Doctor by the University of Giessen. In the same year he started on a course of travel, which he pursued through the West Indies and parts of the North-American continent, and after his return to Europe in 1856 he began the publication of a vast number of works on a great variety of subjects—geological, zoological, ethnological, geographical and historical. Especially large were his contributions to Entomology, and among these the Hymenoptera and the Orthoptera in particular claimed his attention. He died on the 20th February, 1905, lamented for his deep and wide knowledge and for his attractive personal qualities.

A veteran English entomologist, John William Douglas, elected in 1845 a Fellow of this Society, of which he became President in 1861, died on the 28th August, 1905, in his

ninety-first year. As a young man he obtained a situation in the Customs House, where he rose to a high position, retiring at the age of seventy after more than fifty years' service. His first entomological paper was published in the "Entomological Magazine" for 1837. In 1874 he became one of the joint editors of the Entomologist's Monthly Magazine, retaining that position for thirty years. Associated with the leading English entomologists of his day, including Stainton, whose residence was near his own, he extended his studies from the Lepidoptera, with which he began, to the Coleoptera and other orders, rendering important assistance in the production of Stainton's "Natural History of the Tineina" in 1856, and in 1865 he was one of the joint authors of Douglas and Scott's "British Hemiptera." His works on the Coccidæ are very valuable. During his long life he did much to promote the knowledge of our favourite science, and always held a high position in the esteem and affection of his friends.

Lieutenant-Colonel Leonard Howard Loyd Irby died last April at the age of sixty-nine. A Fellow of the Linnean and Zoological Societies, he joined this Society in 1893. Retiring after service through the Crimean War and the Indian Mutiny, he devoted himself to several branches of natural history, especially ornithology, on which he published a work, "The Ornithology of the Straits of Gibraltar," that went through several editions. He was an enthusiastic collector of Lepidoptera, a first-rate shot, and his friends found him a most charming and genial companion.

Alexander Fry, born in 1821, went in 1838 to Rio de Janeiro, where his father had a mercantile house. There he devoted much time to collecting Coleoptera. After 1854, barring occasional visits to Rio, he resided in England, adding by purchase and otherwise to his collection, which at his death reached the enormous number of some 200,000 specimens, all of which, well arranged and for the most part named, he bequeathed to the British Museum, where they occupy 29 cabinets, containing 348 drawers, and 400 boxes. He became a Fellow of this Society in 1855, and died 26th February, 1905.

George Bowdler Buckton, F.R.S., had been a member of the Entomological Society from 1883. Incapacitated by an

accident in early life from active pursuits he turned his attention to science, and in 1867 carried out some important original work, in recognition of which he was that year made a Fellow of the Royal Society. In 1865 he settled at Haslemere, where he died on the 25th September, 1905. Mr. Buckton was the author of valuable entomological works. His monograph of the "British Aphides," in four volumes (1876–1883), was followed in 1890 by his illustrated monograph of the "British Cicadæ or Tettigidæ," and afterwards by the "Natural History of *Eristalis tenax*," and by various published papers. Most of the plates in these works were drawn and in some cases lithographed by himself. Mr. Buckton was a member of the Linnean Society, the Chemical Society, and of several foreign scientific societies, many of the meetings of which he attended, and by the members of which, as well as his numerous private friends, his kindly and courteous presence will be missed.

I ask leave this evening to bring under your notice a subject on which entomologists have thrown some light, but which by common consent stands in need of much more; to call attention to some of the effects on living things of that chief element in climate, temperature, and to the remarkable limitations imposed on those effects by the nature of the living thing operated on, these two opposing forces giving rise to a state of conflict between the outside power and the organism.

General operation of temperature.

The general effect on a growing organism of an augmented temperature, within the limits of healthy vitality, and associated with other wholesome conditions, is well recognized, as promoting physiological activity, heightening energy and accelerating development. The whole practice of "forcing," as applied in many industries, by florists, market-gardeners, chicken-farmers, and others, is founded on this principle, and entomologists every day come upon illustrations of it.

Insensitiveness of many organisms.

And yet we know there are myriads of insect organisms in an immature condition, apparently waiting for nothing but development, which are absolutely insensitive to the influence of a heightened temperature, nay, in some cases, as it were, resent that influence, and are moved by it in the opposite direction, that of delay or postponement. This radical distinction in physiological character is one that is met with throughout the Lepidoptera, and, of course, elsewhere in the animal kingdom. Individuals belonging to the same family, the same genus, the same species, even the offspring of the same parents, are found separated into these two distinct physiological classes.

Regular response of one class.

The first class—those that yield to temperature—seem usually to respond to it with a regularity which is noteworthy, in many instances all emerging to the very day. I give examples, summer pupæ of some common English species, showing this.* (See Appendix, Table I.)

Resistance of another class.

As examples of the other class, that on which warmth is expended in vain, we have such species as *Euchloë cardamines*, *Araschnia levana* (winter phase), *Pieris brassicæ* (winter phase), *Selenia tetralunaria* (winter phase), some experiments on most of which are described later.

I am not suggesting that the second class, those non-responsive to temperature, are thus insensitive throughout their lives; the insensitiveness may be confined to certain metamorphic stages, or even to certain periods comprised in those stages; when, for example, any of them shake off their long torpor

* In my experience eggs of most Lepidoptera that are laid at one time in summer hatch out nearly all together, in this respect differing greatly from many of the wintered eggs, such as those of the genus *Ennomos*, and of *Liparis monacha*, which usually spread their hatching over a very long period with little regard to temperature. In this respect there is a parallel between the egg and the pupa.

and begin to move actively towards emergence, the pace at which they do so is accelerated by warmth, and retarded by cold.

Nor do I suggest that all individual Lepidoptera belong, throughout their lives, or even throughout any one metamorphic stage, to one or other of these two classes, nor that the element of personal variability does not come in largely, so that there are many species and individuals which may be described as intermediate, though often very discontinuously so.

Physiological dimorphism.

I shall have to advert, rather fully, to that very numerous and remarkable class called double-brooded (digoneutic and bivoltine), which in one of their "phases"—to adopt the term suggested by Professor Poulton—belong to the sensitive, in the other phase to the insensitive, thus exemplifying the kind of diversity to which Dr. Dixey has given the apt name of "physiological dimorphism."

Nonseasonal Lepidoptera.

The climates of the world may be divided into the nonseasonal and the seasonal, the former consisting of those equatorial or tropical regions where, with a temperature averaging something over 80° F. (27° C.),* not much above and very little below, and with adequate humidity all the year round, these conditions continuing the same year after year, species abound whose "little lives are rounded" in a month, regions where at all times and in all their stages—egg, larva, pupa, and imago—they are to be found simultaneously and in nearly equal abundance—such species as the *Heliconias* and *Ithomias* of tropical South America, and the *Ypthimas*, etc., of the Indo-Australian region. I do not know the life histories of these species, but, looking to the regularity with which generation succeeds generation, it may perhaps be assumed that so far as the operation of the temperature—itself so regular—is concerned, there is nothing in a nature bred under these conditions to prevent that general effect which I have adverted to

* For convenience I have in all cases given, approximately, the Centigrade degrees.

—*i.e.* that warmth heightens and accelerates, and coolness retards, in other words, that these species would respond in a normal manner to change of temperature within the limits of health.

Seasonal influence—Temperature.

The rest of the world is all more or less "seasonal" and the main distinction between the seasons is that of temperature. In many countries containing an abundance of Lepidoptera the principal climatic distinction is that between dry and wet seasons, these, however, being often more or less associated with changes of temperature. The recorded accurate observations on the effects of temperature in relation to Lepidoptera are far more considerable than those on the effects of wet and dry seasons, and, without in any way seeking to minimize the operation of these, I practically limit myself to the former, not only because I think it the most far-reaching and penetrating influence, but also because the materials accessible for the purpose are so much more abundant.

Seasonal Lepidoptera.

There are, as we know, places extreme in climate, such as North-Eastern Siberia, where the annual range of temperature is over 100° F. (56° C.), from about – 50° F. (– 46° C.) in January to over + 50° F. (10° C.) in July, and the polar regions, where some of the Argynnids and Satyrids are found, and where the actual life of a butterfly is limited to about a month, though the whole duration of its life may extend over several years, and the food plants are covered with ice and snow except for about six weeks. Though the range of temperature in the seasonal world in general does not approach such extremes, the seasons are strongly marked in most of it, and whenever the winter is sufficiently severe, either by its direct effect or its indirect effect in destroying green food, to impose a lengthened period of rest, the Lepidoptera are, like the climate, seasoned in their habits; and, the seasons having an annual cycle, the normal life of a lepidopterous insect is annual also, or at least is comprised within a year, its rate of

development, in conformity with the general law adverted to, being, as a rule, rapid in the warm season, slow or even arrested during the colder part of the year.

Year-lived Lepidoptera.

The more usual case, at least in our latitudes, may be taken to be that of insects which live a whole year, constituting those seasonal species which are usually called single-brooded, but which it might be more convenient, as their whole life is in question and the term "brood" is often used in a different sense, to call "year-lived." These, in contrast with the non-seasonal species, are in general, in their four several stages—those of egg, larva, pupa, and imago—associated respectively with particular seasons of the year, and any of their stages, varying however according to species, may be associated with any season.

It will be convenient here, as the foundation for some of the observations that follow, to refer to a few familiar examples of the extreme persistence in their habits, in disregard, apparently, of very great differences of temperature, of some of the "year-lived" class, so numerous in temperate countries, and to select for that purpose some that pass the winter in varying stages. *Euchloë cardamines* ranges over Europe and a large part of Asia, and is found plentifully at low elevations as well as up to 7,000 feet above the sea level. Appearing on the Riviera in February or March, and in the mountain districts found occasionally as late as August, it pupates usually in the early part of summer and then (with rare exceptions, if any) quietly bides its time through all the hottest part of a South European summer until the spring of the following year. This is an insect which has a winter pupa. The same rigid adherence to the one-year cycle is shown generally by the Erebias and other Satyrids, chiefly mountain insects, but many of them found in the warmer plains; these pass the winter in the larval stage, as does *Aporia cratægi*, a very abundant species with wide geographical range. A similar fixed yearly life is shown by species which, like *Argynnis adippe*, *Augiades comma*, *Lycæna ægon* (*argus*), the

Theclas, and the Geometrid moth *Eunomos angularia*, pass the winter as eggs, and by *Scoliopteryx libatrix*, and many other moths which hibernate in the winged stage. So the cold-weather moths of autumn, winter, and early spring, the four common *Hybernias* and *Cheimatobia brumata* and *Phigalia pedaria*, rapidly run through the stage of larva in about two months, and lie all through the greater part of the year, including its hottest period, before they emerge as moths.

Cold required to mature winter pupæ.

A continuation by artificial means of heat not only fails to accelerate but often retards or kills, and in some cases throws the emergence over to another year, so that in these cases cold is necessary to accelerate or cause maturity. Four *Thais polyxena*, a year-lived spring butterfly of Southern Europe, were placed by me at 80° F. (27° C.) on each of the following dates, 12th November and 31st December. All were dead by 14th March except one of the first lot, which emerged a cripple 28th December. Of four placed there on 14th March and two at 92° F. (33° C.) on 25th March, all emerged; of some that were left out of doors all, or nearly all, emerged 16th to 30th May. Ten *Rumia luteolata* placed by me on the 18th October at 80° F. (27° C.) were all dead by March; ten placed there on the 20th March all died except three, which emerged from the 4th April to the 2nd May, one being a cripple; of twenty placed there on the 2nd May, twelve emerged between the 6th and 22nd May; many left out of doors emerged between the 17th and 31st May, and a few later. Of twenty-five *Hybernia marginaria* placed on the 19th October at the more moderate temperature of 63°–70° F. (18°–21° C.), not one had emerged by the 1st March, by which time many at the temperature of a cold room had emerged. Of seventy-five *C. brumata* brought indoors when the weather began to be cold in October, and on the 2nd November placed at 63°–70° F. (17°–21° C.), not one had emerged by the 12th January, when many at the ordinary temperature had emerged; some of them had been killed by the warmth indoors.

but most apparently had been sent over by it to wait for a second winter.*

There are many other species which, though not so obstinate as those which have been mentioned nor perhaps so ready to die or to postpone emergence for a year, show an equally determined resistance for a shorter period. These species probably belong properly to a somewhat warm climate and are attuned to a shorter winter.

Mediterranean species.

Wholly opposed in their constitution to the seasonal year-lived species are many belonging to parts of Southern Europe and of Northern Africa, bordering the Mediterranean, where the summer is warm and long, the spring and autumn mild, and the winter not severe enough to prescribe any lengthened rest, and where accordingly, though no rapid multiplication of generations approaching to that of the equatorial regions exists, the year, with its marked seasons, is no longer with many species the usual period of life, but they breed on, generation after generation, continuously, getting in three or four or more generations annually.† This is exemplified with such species as *Pyrameis cardui*, *Colias edusa*, *Phragmatobia fuliginosa*, and *Plusia gamma*. These would appear physiologically to belong rather to the equatorial non-seasonal than to the seasonal class, and at all events seem to have little of the seasonal character stereotyped upon them.

The seasonally double-brooded.

It is now time to refer to that remarkable class usually spoken of as the seasonally double-brooded, producing two or sometimes more generations in the year; one, the "winter phase," that which in our climate lives about nine months, including the winter, the other, the "summer phase," living about three months, May to August; the one having a pupal period of

* Similar occurrences are frequently recorded in entomological publications. (See Dr. Chapman, Ent. Record, vol. i, p. 127, and the Ent. Record, *passim*.)

† See Tutt in Ent. Record, vol. x, pp. 211, 212.

about seven to eight months, the other of a few weeks, and the two phases, as will be seen, differing to such a degree physiologically, that the winter phase is killed by the temperature in which the summer phase flourishes; often differing also in size, shape and colour, and I believe frequently in habits. The winter phase appears to have much more in common physiologically with the "year-lived" species, the summer phase belonging on the other hand to the equatorial or the Mediterranean type.

*Examples of winter pupæ killed by warmth.**

Among these let me first mention the famous *Araschnia levana*, much the most striking of seasonally dimorphic European forms of butterfly; the winter phase being on its upper surface of a bright orange brown, mottled with black, having a general resemblance to some of the little "fritillaries" (*Melitæas* and the smaller *Argynnids*) so abundant in spring, the summer phase black, with an oblique white band running down both pairs of wings, much as it does with the common *Limenitis sibylla*. The pupæ of the summer phase respond to temperature most readily, those forced emerging in about six days with great regularity; if on the other hand cooled, they are retarded for a period of, it may be, many months. To the effect of such cooling on the facies of the imago allusion will be made later. In 1895, between the 22nd and 29th August, I received from various parts of Germany, North, Central, and South, many hundreds of larvæ of *A. levana* of various sizes from half-grown or less upwards; many were very kindly sent to me from Freiburg by Prof. Weismann. These pupated from about the 28th August to the 2nd September. A large number were on pupation placed in the refrigerator at about 46°–50° F. (8°–10° C.) for eight weeks, *i. e.* till 26th October, when they were placed out of doors, batches being transferred at about fortnightly intervals to incubators (at 92° F. (33° C.) and 80° F. (27° C.)—it made no difference which). Some were left out of doors from pupation, and 53 of these emerged between

* See Table II in Appendix, Experiment 1.

2nd April and 7th May. It will be seen by the tables in the Appendix that all those transferred to the incubators in less than 13 (perhaps 15) weeks after pupation died; after that a proportion died, gradually diminishing until the 29th week, after which all survived.

A large number during the first eight weeks were left in the room at a temperature which may be taken at 5°–10° F. (3°–6° C.) above that of outdoors. These were afterwards transferred in batches to the incubators. All so transferred up to the 19th week died; after which a proportion, gradually, but irregularly, increasing, but never the whole of those transferred, survived.* (Of some left in the room until emergence, 23 emerged between 24th March and 31st May.)

Of a third lot left in the room until 13th January (19 weeks), when they were placed out of doors and from 7th February (24 weeks) transferred as before to incubators, some of each batch transferred survived, the proportion being larger than in the last experiment.† (Some of them, left out of doors from the time they were placed there, emerged, to the number of about 20, between 26th April and 19th May.)

Experiments with other seasonal double-brooded species show an equal resistance to a heightened temperature on the part of the winter phase. Thus, of 40 English pupæ of *P. brassicæ* forced at 80° F. (27° C.) from the 29th November, 1897, all but 7 were dead by 23rd March, 5 more by 18th April, the remaining 2 on 22nd May, one of these last in attempting to emerge. Eighteen of the same batch were iced 29th November, and forced on the 23rd March; 11 of these emerged between the 3rd and 6th April. Another lot of 36, received on the 30th December, 1900, were kept out of doors; of 10 forced 1st March only one emerged, on 21st March; of 6 forced 19th April only 2 emerged, on 30th April; of 6 kept outdoors all emerged from 30th May to 2nd June.

Many experiments tried by me on *Selenia tetralunaria*, some of which are recorded in the Transactions and Proceedings of this Society, show somewhat similar results. As to the summer phase of this species, when the pupa is forced at about

* See Table II in Appendix, Experiment 2.
† *Ibid.*, Experiment 3.

80° F. (27° C.) it emerges with great regularity in about 8 or 10 days; but the winter phase behaves very differently. Of 16 forced at 80° F. (27° C.) on the 26th November, 1890, and 11 more forced 14th December, all were dead by 1st February; of 16 kept at the more moderate temperature of 60° F. (16° C.) on 26th November all were dead by 16th March; many were iced 26th November to 24th December; of 8 of these forced 24th December and 7th January at 80° F. (27° C.) 6 died and 2 emerged, one a cripple; while of those not forced until the 21st January or later, nearly all emerged and with fair regularity.

Tolerance of cold by summer pupæ.

In contrast with winter pupæ killed by the absence of cold, reference may be made to the much greater tolerance of an unaccustomed temperature shown by the summer pupa of *S. tetralunaria* and of *A. levana*, which I have kept, retarded and changed in facies but uninjured by a low temperature, for more than four months, that of *Z. punctaria* for more than six months.

Three or more broods.

The resemblance of the summer phase to the continuously brooded is perhaps also indicated by its readiness to repeat itself by interpolating one or more broods between its first and latest broods, which is so commonly the case in a hot season, all but the last of them showing the characteristic quality of the larvæ of the summer phase, *i. e.* the feeding up fast. The entomological periodicals contain frequent instances of this. *A. levana* in a hot summer often produces a third brood, and *S. bilunaria* (*illunaria*) from eggs of the spring brood this year, has given me four subsequent complete generations all of the summer phase, having been kept by me at 70°–80° (21°-27° C.) during their whole lives, the time occupied by them from the laying of the first egg to the emergence of the last imago having been only about six months, *i. e.* from 31st March to 2nd October. Thus, moths of five generations succeeded each

other within about six months. They then came to an end without giving rise to a winter phase.

"Splitting."

I have treated the tendency to be single-brooded, or the reverse, as usually congenital in the individual; and I think this is proved by the common phenomenon which I have called "splitting," met with in nature and in home-breeding, when part of a brood from the same parent, all bred under similar conditions, divides, one portion feeding up hastily, and within the year, the other portion feeding slowly and the pupa resting peacefully till the following year. This separation, I think, most usually shows itself in the larval stage, when the "forwards," to use Dr. Chapman's name for them in his experiments with *Arctia caja*,* feed up rapidly and voraciously, the others biding their time; his explanation being that *A. caja*, as we find it, is a mongrel having two or more races mingled together in its composition.

Though the character of the winter phase is in many cases impressed so deeply on the individual as to render it immovable in its habits, there is a vast number of cases in which it is not so. The books are full of accounts of Lepidoptera, ordinarily single-brooded in England, which give out a second or even a third brood in a hot summer, and the degree of instability in this respect varies greatly not only as between different species, but as between different individuals.

Conversion of one phase into the other.

Reverting to those individuals on which the physiological character, *i. e.* that of the summer or winter, is strongly impressed, it seems proper to say something on the difficult problems connected with the *conversion*, complete or partial, of one of these phases into the other.

Conversion in the pupal stage.

To deal in the first instance with conversion in the *pupal stage*, let me point out that it appears to be usually easier to convert the summer phase into the winter than the opposite,

* Ent. Record, vol. iv, pp. 265 *et seq.*, and vol. v, p. 33 *et seq.*

often found impossible, and that the conversion can be made very thoroughly so far as many characteristics go, for example as to colour and markings (or pattern). For results obtained in this way, I may refer to papers contributed by me to the Society's Transactions, which Dr. Dixey has done me the honour to epitomize most accurately in an article in "Nature" of 23rd December, 1897.*

Some observation has been made † on the distinction I have drawn between "markings" (pattern) and "colouring," but I do not think any one who has seen the results of my experiments can doubt that the distinction is a real and very substantial one. To speak first of the markings (pattern), a striking change in these is caused by the exposure for many weeks of the summer pupa of *S. tetralunaria* to a low temperature; further, this change is distinctly in the direction of (I do not say it exactly reproduces) the pattern which the spring emergence bears. It begins to show itself after about six weeks of the low temperature, and becomes the prevailing pattern after about eight weeks, though even after twenty weeks there is an occasional reversion to the usual summer pattern.

Standfuss and Fischer's experiments.

Probably many of my hearers are conversant with the wonderful results (far surpassing mine) of high and low temperatures in altering the colouring and patterns of Lepidoptera, especially the Vanessids, obtained by Prof. Standfuss ‡

* It may illustrate the plastic character of the summer compared with the winter phase of *S. tetralunaria*, to mention that with the winter pupa one can only alter the colouring, but with the summer pupa one can alter either colouring or markings, or both. Where extreme temperatures are used, some of the effects are doubtless to be ascribed to physiologically injurious conditions; and in the converse case, where the artificial conditions are specially favourable to vigorous development, such as warmth combined with moisture, the resulting imagines may be expected to attain large size and great brilliancy, as they would in nature. (See Mr. Elwes, Proc. Ent. Soc. for 1891, p. viii.) Length of time in feeding up (and in pupa) seems to be connected with the large size and strong marking of the winter phase of seasonal double-brooded Geometrids.

† Weismann's "Neue Versuche, etc.," translation by W. E. Nicholson, p. 59, reprinted from "The Entomologist," January–August, 1896.

‡ A translation by E. M. Dadd, F.E.S., of Prof. Standfuss's "Synopsis of Experiments to the end of 1898," appeared in "The Entomologist," 1900–1901, and has been reprinted. I have seen no translation of Dr. Fischer's papers, but hope to have an opportunity of referring more fully to the valuable researches of these gentlemen at some future time.

and Dr. E. Fischer, who used for the most part temperatures more extreme than those which I employed. This is not the occasion for setting forth the different theories ably stated by those gentlemen in explanation of the results obtained, both invoking to some extent "arrested development" as their cause, and, as development is arrested by abnormal heat as well as by abnormal cold, the theories are strongly supported by the fact that there is a striking similarity between many of the results of the application of directly opposite temperatures.

The difference in size between the two phases is often so great that in the pupal stage there can be no complete conversion in this respect, and I think it may be doubted whether in this stage even the summer phase is ever converted physiologically, *i. e.* so as to give to a summer pupa the tendency to lie over for many months, as distinguished from the mere temporary retardation imposed as the normal effect of a low temperature.*

Conversion in earlier than pupal stages.

There is evidence, however, that in stages earlier than the pupal the conversion of individuals may be complete. Dr. Chapman in the paper I have adverted to mentions that he finds about 5 per cent. pretty regularly of the larvæ of a brood of *A. caja* to be "forwards," *i. e.* to be ready (under the very slight encouragement it would appear of an indoor life, with its somewhat higher temperature, and perhaps without it) to feed up rapidly in about three months, and emerge the same summer instead of hibernating as larvæ; and he records that, of a brood which he sent to me for experiment and which were forced by me, 75 per cent. so fed up in about two months.

But it must not be assumed from this that conversion from the winter to the summer phase can generally succeed with half-grown larvæ. In 1895, from the 22nd to the 29th

* As regards size, it is noteworthy that the summer insect is often the smaller, usually so, I think, in the Geometrid moths; in the *Selenias* the size is much less. In *A. levana*, on the other hand, the butterfly from the summer pupa is the larger.

August I forced at 70°–80° F. (21°–27° C.) a large number, nearly 100, of larvæ of *A. levana*, many not more than half grown, the pupæ being from pupation kept for months at about 70° F. (21° C.) and removed in batches at about fortnightly intervals to 80°–90° F. (27°–32° C.) or a little higher ; not one was converted by the process into the *prorsa* form, though one was of the *porima* form ; all the rest died.*

I am satisfied that to cause conversion in many cases the temperature must be applied in a very early period in the life of the individual. I have been trying experiments with a view of ascertaining the exact period—varying doubtless in many species—in which to be effective the change of temperature ought to be administered, without having yet attained sufficiently definite results to lay before the Society. I am not sure that in some cases it would not be necessary to make the application of temperature as far back as the period when the egg is laid, and perhaps at a time when it is still unlaid, so as to affect the "germ plasm" of the parents or one of them.

Races of Bombyx mori.

The case of the common silkworm moth, *Bombyx mori*, a species which hibernates in the egg, is interesting, as showing how deeply ingrained the tendency to single-broodedness may be as a hereditary character implanted in different races of a single species. The race ordinarily cultivated in the south temperate zone of the silk-producing countries of France, Italy and Central Asia, and in Japan, has many varieties, but (with the exception of a few bivoltine, trivoltine and even quadrivoltine races locally cultivated in parts of Italy) their cycle is annual. And yet there is a race usually cultivated in Bengal which is polyvoltine, producing ten or eleven generations in a year. All the races interbreed freely. So essential is a certain degree of cold to the univoltine race, that in order that the eggs should hatch out healthily when transported to the Punjab and Dehra Dun, which has been done to improve

* Of 24 not thus forced as pupæ but kept out of doors 16 emerged in the spring.

the Indian breeds, the eggs have to be sent up annually to the Himalayas for the necessary cold.*

Single and double-brooded—Difficulties of transformation.

It is sometimes thought that a fixedly single-brooded species has only to move south sufficiently far to easily establish itself there as a double-brooded one. But is this so? If you try to work out, as I have done, the case of such a single-brooded insect going south, I think you will find the difficulties arising from want of *fit* between the seasons and the habit of the species (to say nothing of the competition it would have to meet) such as to render its task in establishing itself a lengthened and by no means an easy one. The opposite case of a double-brooded southern species going north would, I think, be a little less difficult, because a species having the inherent capacity of being double-brooded can better adapt itself to circumstances, though even here I think most of its attempts would be failures.† I believe, however, that an altogether non-seasonal species where all the pupæ are of the same physiological type, regularly responsive to temperature, would find the change more easy.‡ Supposing an equatorial species having ten or twelve generations in a year to flow over northwards, as it appears frequently to do,§ it would only have to reduce the number of these gradually in natural response to the lower temperature, as it spread over cooler regions. When they came down to three or four, one of which would have to encounter a very mild winter, to prolong this one in accordance with the lower temperature of that season over three or four months, would gradually bring it to the South European or Mediterranean continuously-brooded type. Finally, having regard to the plastic character of its pupa, it might, after a long period of probation and many vicissitudes, become seasonally double-brooded.‖

* See "Silkworms in India," by E. C. Cotes, Indian Museum Series, vol. i. I am indebted to Major Alcock, F.R.S., C.I.E., Superintendent of the Calcutta Museum, for these volumes.

† On this see Tutt in Ent. Record, vol. x, pp. 211, 212.

‡ See Tutt, Ent. Record, vol. vii, p. 6.

§ See Ent. Record, articles on Migration, vol. xiv.

‖ In dry countries the period of hot weather resting, æstivation, would come in as an element, as in the case of *Ocnogyna bætica*, mentioned by

The abundance of Lepidoptera in warmer regions, and the vast number of their individuals, arising out of the frequency of their broods, would tend to overspills, and the evidence of actual migration is in favour of its having been mostly in a direction that would point to these regions as the source.*

I do not suggest that in any of the cases the difficulties are insuperable, and one can see that even when there is so great a physiological gulf as that between the summer pupa of a double-brooded insect and the winter pupa of a single-brooded one, there are stepping-stones across it, such as variability of climate in the same locality, variability in individuals, and possibility of overlapping resulting in fusion by mating of different generations. And many species are probably at all times in an unfixed, perhaps intermediate and transitional condition, such as those single-brooded species, which frequently under the stimulus of a hot season bring forth wholly or partially a second brood, often ineffectively, it is true.†

Altering pattern by temperature.

I have referred in general terms to the effect of the application of temperature in the pupal stage in altering the colour and pattern of the wings of Lepidoptera. To attain this result in a high degree it is usually necessary to apply the temperature from the time when the newly-formed

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Dr. Chapman, Ent. Record, vol. xvii, p. 266. As to hibernation, it is not suggested that this is only caused by cold, or æstivation only by heat or draught. There is an interesting discussion on this by Mr. Tutt, Mr. de Vismes Kane, Dr. Ridding, Dr. Dixey and others in Ent. Record, vols. vii and viii.

* See articles by Tutt in Ent. Record, vol. xiv, pp. 262, 292, and 315. "Broadly speaking, the dispersal movements of insects . . . are . . . from sub-tropical to temperate regions. . . . The general trend . . . in the Northern hemisphere is northerly and in the Southern hemisphere is southerly." I have only mentioned migration, which is operative before our eyes, but I am not unmindful of another potent way in which climate may affect organisms, and one that has doubtless been highly effective in the past, and that is where, instead of the organism migrating to the climate, the climate comes to the organism, in the great secular changes which have taken place; heat and cold having at different periods characterized most of the Palæarctic region, and having had their turn in starting or moulding the forms that have descended to our times.

† Warm climates where there are considerable mountains would seem suited to qualify species for acclimatization, though, as we see, many of the species generated in such countries remain obstinately single-brooded.

pupa hardens until near the end of the pupal period. Experiments tend to show that a winter pupa is in a state of almost absolute torpor for a long period,* perhaps up to the time when it has been subjected to cold sufficiently long to bear the application of a forcing temperature, but that, after that time, though the cold may continue, the development begins to move very slowly forward, for it will emerge in a shorter time if the forcing is deferred until long after that critical period has been surmounted, than if forced at once. In the case of summer pupæ, there appears, however, to be but a short period, if any, of torpor; my experiments with *S. tetralunaria* have shown that the pupal period of this summer phase can, by icing, be protracted to 22 weeks, and that changes in the facies of the moths that came from pupæ transferred to a warmer temperature began in six weeks, *i. e.* long before the middle of the pupal period.

"Direct" effect of temperature.

But besides these changes, which—at least most of them—cannot be ascribed to the direct effect of cold, there are others which may be called by way of distinction direct, and these I have found to be produced mainly (in the case of some species I may say exclusively) in the latter part of the pupal period.

I do not think sufficient regard has been given to what may thus be called the "direct" effect of temperature during the pupal period on the colouring of Lepidoptera. But there is no manner of doubt that it has such an effect, and in many cases this effect is so considerable that it may have protective value. As already stated, many of the seasonal differences, and those much the more striking, must find an entirely different explanation, that is to say, in the hereditary predisposition of the organism called into operation by the appropriate stimulus (as the fur of the Arctic hare is whitened by the advent of winter cold); for example, the differences in *A. levana* and, to take a marvellous example, those in a species of *Precis*, the one phase, *P. octavia-natalensis*, being on the

* The torpor often lasts for years, as in the numerous cases where winter pupæ lie for several years in that stage.

upper side deep salmon-red with black borders and spots, the other, *P. sesamus*, violaceous blue streaked with black, and with a continuous series of salmon-red spots.*

Affects general colouring.

The effect to which I am calling attention is one which shows itself especially in the ground colour and general colouring of the wings and body. It may be stated as follows:—The higher temperature tends to produce a light yellowish brown passing on to chestnut or ochreous and orange, the low temperature dark, and in places blackish brown, the darkening effect showing itself in general, not merely in the ground colour, but also in some or most of the clouds and spots of different colour that diversify it, giving it in some cases, where these spots consist of single scales, the appearance of increased irroration. This kind of difference (frequently associated, in the facies presented by an insect subjected to severe or lengthened exposure, with the more deep-seated and often much more striking change of pattern and colour above referred to as arising out of a hereditary predisposition that is merely awakened by the stimulus) I have found in Lepidoptera, so widely separated from each other as *P. machaon*, *A. cratægi*, *E. cardamines*, *L. sybilla*, *P. atalanta*, *P. cardui*, *V. urticæ*, *V. polychloros*, *Polygonia c-album*, *Melitæa aurinia*, *M. cinxia*, *M. didyma*, *Argynnis paphia*, *Zephyrus betulæ*, *Orgyia antiqua*, *Lasiocampa quercus*

* Mr. Trimen's Presidential Address, Proc. Ent. Soc., 1898, p. lxxii, which gathers together all the knowledge on "seasonal dimorphism" up to that date, since which important additions have been made especially by Mr. Guy K. A. Marshall, 1896–1901. See the joint paper below referred to pp. 287–585; also Dr. Dixey, in Trans. Ent. Soc. 1902, pp. 189–218, and Proc. Ent. Soc. 1902, pp. xv–xviii, on Mr. Loat's collection, Proc. Ent. Soc. 1903, pp. xi–xiii, and Trans. pp. 141–164; Poulton, Proc. Ent. Soc. 1903, pp. xxxii–xxxiv; and Lathy, Trans. Ent. Soc. 1903, pp. 183–206. As to the protective value of the different colouring—extending also to habits—of the two forms of this species of *Precis*, see Mr. Guy A. K. Marshall and Professor Poulton's joint paper, Trans. Ent. Soc., 1902, p. 424 *et seq.* In the case of *A. levana*, I do not know that more can be said than that there is probably something advantageous to a summer butterfly in the general colour and pattern on the upper side, combined with powerful flight, that is common to so many of them (*Limenitis*, *Apatura*, *Satyrids*), and that the summer form, *prorsa*, of *levana*, has a great resemblance to them in all these respects. And such of these external appearances as are not in themselves useful, may be the outward and visible signs, the correlatives, of physiological adaptations beyond our ken. (See Professor Meldola's Presidential Address, Proc. Ent. Soc., for 1896.)

(and var. *callunæ*), *Saturnia pavonia*, *Drepana falcataria*, *Z. punctaria* (both broods), *S. bilunaria*, *S. tetralunaria*, *S. lunaria* (both seasonal forms of these three species), and *Ennomos autumnaria*. With several other species I have found no appreciable difference of this general character caused by temperature, and in those I have mentioned it varies very greatly in degree. In some of these, *e.g.* the *Selenias*, especially *S. tetralunaria*, the difference is striking, being equal to that between a dead leaf in a dry August and the same, moist and darkened by a wet winter; corresponding, in fact, very closely to the difference in appearance between the summer and spring phases of this insect, either of which can be converted into a colouring approaching that of the other by the appropriate temperature, a few days being sufficient for the purpose where it is a case of high temperature which greatly shortens the pupal stage. I do not hesitate to say that in many species much the most conspicuous difference caused by special temperature, experimentally applied, is that which is caused by this "direct" effect during the latter part of the pupal period, and a given temperature must have the same effect in nature if the only difference between the two cases is that in the one it is applied by man in a laboratory, and in the other by nature in a field.

In using the term "direct," I do so by way of distinguishing it from that previously spoken of as based on hereditary predisposition. It is not at all the same thing as, for example, the direct effect of heat in coagulating albumen, or of light falling on a photographic plate, or developing green chlorophyll, or the bright colour of a budding flower. The whole effect on the colour of the imago is caused before its colour begins to appear through the transparent skin of the pupa. Remove the pupa into a normal temperature at this time, and the colour comes out just the same as if the removal had not taken place. It must therefore be caused through some vital process * acted on by the temperature at a somewhat earlier period, though in general later than that at which the pattern is determined.

* Of a nature, I suggest, resembling that which Professor Poulton has shown to be concerned in the colouring of pupæ by the surroundings of the larva before pupation.

It is perhaps to be expected that this alteration of colour in the wing should take place during the latter part of the pupal stage, for it is at this period that the hæmolymph or blood from which the pigment of the scales is formed flows into them.* This hæmolymph, at first yellow and then drab, can by various chemicals be made to assume many colours, including reds, yellows and bright carmine. We have thus the raw material provided by nature out of which various colours can be elaborated.

Is it protective?

Is this difference in ground colouring which I have described protective? I think there is ground for saying that it may be so. It has a strong likeness to the difference between the general aspect of vegetation in different seasons, between a hillside parched by an August sun and the dark stems of the undergrowth of wet woodland; and the lighter coloured insect should be better adapted for concealment in seasons or in regions where the colour of dead vegetation is the prevailing one.

Can these temperature effects become hereditary?

There is weighty opinion in favour of the view that some of the effect produced by abnormal temperature on the facies of a butterfly of which the pupa has been exposed to it for a single generation can be passed on to the progeny. Professor Standfuss adduces evidence to that effect in the case of *V. urticæ*. Dr. E. Fischer has stronger evidence, derived from some experiments on *Arctia caja*. Professor Weismann accepts the conclusion that in these cases the aberrations of the parents induced by cold descended in a considerable degree to the offspring, explaining this by the view that the germ plasm is affected, some of the "determinants" being strengthened, others weakened by it;† and he elsewhere

* A. G. Mayer, "Development of Wing Scales," etc., Bull. Mus. Comp. Zoology, Harvard College, June 1896, as to the vital structure developing in the pupa earlier than in the wings. See Ent. Record, vol. i, p. 298.

† Weismann "The Evolution Theory," translated by Mr. and Mrs. Thomson, vol. ii, pp. 267 and 275, also p. 137. See also his observations on my experiments on *C. phlæas*, Neue Versuche, etc., English translation, p. 10.

observes, "it is indubitable that external influences such as those emanating from the environment or media in which the species live, are able to cause direct variation of the germ plasm that is permanent because hereditary."

But when the effects on the individual are only transient there would still remain scope for the great factor in evolution, natural selection, because the tendency to respond in general colouring to the temperature undoubtedly varies, and, if it be protective, an individual ready to respond in this way would have an advantage which natural selection could secure to the species.

Two varying aspects of Nature.

But, do we find any correspondence between the colouring produced by high and low temperatures respectively on Lepidoptera and the general colouring of those found in warm and cold countries respectively? I think we do.* I have looked through some of the families genera and species that are spread over cold regions as well as over temperate and warmer parts, among them Argynnids and Satyrids, in the Natural History Museum at South Kensington, and they seem to me to show the following results. In those from very cold regions the ground colour tends to a uniform dulness with sparseness or diminution in size of scales, and consequent "greasy" appearance, owing to the shining membrane of the wings showing between the scales, and paucity or indistinctness or want of force in the markings. In those taken in what may be described as the cold temperate regions, there is a greater tendency towards bright light brown ochreous or fulvous, the sort of colour so very common in butterflies, shown for example by the bright parts of the wing of *Pararge megæra*, or the female of *Epinephile jurtina*, and to greater variety of marking. In those from the warmer temperate countries there is an

* *P. cardui* is much darkened by exposing the pupa to a low temperature. On the other hand, specimens placed at a high one have a beautiful light brown golden hue extending over much the greater part of the hinder wings and a large part of the forewings, but without a trace of the rosy colour on the upper wings which gives such a charm to ordinary English examples when fresh. I was interested in seeing by a notice in the Ent. Record, vol. xii, p. 156, that an African type is much less rosy than the ordinary European form.

increased tendency towards brightness in place of sombreness, and an increasing variety of marking and colour. My knowledge, however, of the butterflies of the world is so limited that I should have distrusted my own conclusions had I not found support for them in the opinions of several others better acquainted with the subject whom I have consulted. Perhaps on this point I may refer to the remarks of your former President, Lord Walsingham (Proc. of Ent. Soc. 1890, p. liv), where he speaks of the general tendency of Arctic Lepidoptera to a certain suffusion of markings and to an increase in the proportion of dull and dingy scales.*

But, whether it is owing to the direct effect of temperature on the individual, or whether it is fixed by natural selection as being transmissible and of protective value, or whether there is a combination of these causes and perhaps others, I think there is no doubt that in temperate countries as a general rule the southern species and the summer broods do in their general colouring vary rather in the direction of light brown, and the more northern species and the spring broods in the direction of darker colouring.

And now let me conclude with a few words of apology for the many imperfections arising from my want of knowledge on points beyond those which I have found opportunity personally to investigate. I think you can rely on my statements of fact, culled from a very large number of experiments, the results of which, however, as a whole, I have not yet had time to co-ordinate, and one can hardly either gather or put forward the facts without some attempts to explain them. As to my ventures in this direction, they may serve as materials for the consideration of others better capable of dealing with such a subject. I hope what I have put forward may be acceptable as a contribution, however slight, to the elucidation of some interesting phases in that perennial conflict between the phylogeny of the organism and its environment which prevails wherever there is life, the ceaseless struggle by which nature

* There seems an exception in the colour *orange* which is so highly developed in some of the Argynnids of the Arctic circle; it seems a brighter kind of orange, however arrived at, from that reached through light qrown referred to at p. civ.

achieves her ends, and from which occasionally some nascent species, the outcome of submerged and slaughtered millions, arises, endowed with vigour enough to seize and hold a place in the select company of the fit ones who survive.

APPENDIX.

Table I (p. lxxxviii).

Regularity of development of summer pupæ.

Number of individuals	Temperatures	Number emerged	Days in pupa
	Pyrameis atalanta		
11	80°–90° F. (27°–32° C.)	11	6
2	62°–69° F. (17°–21° C.) (average 64°)	2	18–19
4	About 56° F. (13° C.)	4	33–35
5	Average about 54° F. (13° C.)	5	43–45
	Chrysophanus phlæas		
10	80° F. (27° C.)	10	6–7½
10	90° F. (32° C.)	10	6–7
6	70° F. (21° C.)	6	11–15
6	Average about 58° F. (14° C.)	6	22–30
10	Average about 56° F. (13° C.)	10	29–33
10	47° F. (8° C.)	3	57–59
	Vanessa polychloros		
20	85°–90° F. (29°–32° C.)	14	6½–7
10	Average 62° F. (17° C.)	10	20–22
10	56° F. (13° C.)	10	40
	Zonosoma punctaria		
21	90° F. (32° C.)	21	4–5
22	70° F. (21° C.)	22	10–11
17	56° F. (13° C.)	17	22–27
13	45° F. (7° C.)	10	57–70
	Pieris napi		
4	90° F. (32° C.)	4	6
4	67° F. (19° C.)	3	12–13

Table II (pp. xciv, xcv).

Forcing winter pupæ of A. levana, 1895–6.

Experiment 1.—Pupated 28 Aug. to 6 Sept. as they did so placed in refrigerator 46°–50° F. (8°–10° C.) till about 26 Oct. Transferred thence to incubator [80°–92° F. (27°–33° C.)] in both at intervals.

Number transferred.	Dates of transfer.	Weeks from pupation.	Number emerged.	Number of days after transfer until emergence.
	26 Oct.	8		All died; those on 1 Dec. probably killed by accident.
	3 Nov.	9		
	17 Nov.	11		
	1 Dec.	13		
8	15 Dec.	15	5	9
14	29 ,,	17	10	10½
12	5 Jan.	18	9	10–11
24	19 ,,	20	15	7–9½
15	2 Feb.	22	12	8½–9
12	16 ,,	24	8	7–8
12	1 March	26	9	6–9
8	15 ,,	28	7	5–6
4	22 ,,	29	4	4–7
8	29 ,,	30	8	4–5½
4	5 April	31	4	3½–4½
8	12 ,,	32	8	1½–4½

Experiment 2.—Pupated 28 Aug. to 6 Sept. Left in room (rather cold and fireless one) till 26 Oct., then transferred to incubators 80°–92° F. (27°–33° C.) in lots at intervals.

Number transferred.	Dates of transfer.	Weeks from pupation.	Number emerged.	Number of days after transfer until emergence.
	26 Oct.	8		
	3 Nov.	9		All died; those on 24 Nov. and 8 Dec. probably killed by accident.
	24 ,,	12		
	8 Dec.	14		
	22 ,,	16		
	5 Jan.	18		
	12 ,,	19		
4	2 Feb.	22	1	12
4	9 ,,	23	1	10
4	16 ,,	24	1	11
4	23 ,,	25	3	7–11
8	1 March	26	4	3–10
4	8 ,,	27	1	7
4	15 ,,	28	3	5–11
4	22 ,,	29	2	2–5
4	29 ,,	30	2	5–10
4	5 April	31	2	3 hours—4½ days.

Experiment 3.—Pupated 28 Aug. to 6 Sept. Left in room till 13 Jan. (19 weeks), then placed out of doors, and thence transferred to incubators at 80°–92° F. (27°–33° C.) in lots at intervals.

Number transferred.	Dates of transfer.	Weeks from pupation.	Number emerged.	Number of days after transfer until emergence.
4	7 Feb.	24	2	10
8	23 ,,	26	3	8–14
8	1 March	27	3	9–11
8	8 ,,	28	5	10–14
8	15 ,,	29	5 or 6	7–10
8	22 ,,	30	5	5–9
8	29 ,,	31	5	4–6½
8	5 April	32	2	8–9

The results of the above three experiments may be compared with Prof. Weismann's experience (Neue Versuche), where of 120 *A. levana* pupæ placed on the 10 Jan. at the temperature of 27°–30° C., 30 emerged at different dates between 18 Jan. and 25 Feb.

GENERAL INDEX.

The Arabic figures refer to the pages of the 'Transactions'; the Roman numerals to the pages of the 'Proceedings.'

The President's Address is not separately indexed.

GENERAL SUBJECTS.

Acari, exhibition of beetles bearing, li.

Acridium ægyptium, found in Bloomsbury, exhibited, iv.

Acrognathus mandibularis, taken at Woking, exhibited, xxxi.

Africa, exhibition of *Pieridæ* from, liv, lxi, lxvi; contribution to the knowledge of the Rhopalocera of, lx; descriptions of new *Halticinæ* and *Galerucinæ* from, lxxvi; new species of *Lasiocampidæ* from, 313.

Agathidium, exhibition of a specimen of, liv.

Agrion armatum, exhibition of British specimens of, xxxi.

Agrotis ashworthi, to be ranked as a *Noctua*, xvii.

,, *tritici*, exhibition of aberration of, lxi.

Algeria, on Hymenoptera-Aculeata collected in, lxiv, 399.

Amara anthobia, from Leighton Buzzard, exhibited, xvi.

America, on new *Satyridæ* from South, xiii, 185.

Amphidasys betularia, exhibition of specimens bred from *A. betularia* var. *doubledayaria*, vi.

Anthribid beetle, exhibition of specimens with crescentic sulcus on the prothorax, li.

Apatura iris, exhibited, xviii.

Apion lævigatum, exhibited, l.

,, *semivittatum*, exhibited, lxv.

Apterygida arachidis, larvæ and perfect insect exhibited, xxxi.

Argyresthia illuminatella, exhibited, xlvi.

Asemum striatum, on the habits of, iv, 165.

Auditors for 1906 appointed, lxv.

Australia, the blind Coleoptera of, xlviii, 365.

Belenois, on the scents of species of, lvii; on variation in, lxvi.

,, *severina*, on the scent of, and exhibition of alcoholic extracts of the wings of, liv.

Birara, on Rhynchota from, xliv, 327.

Biston hirtarius, exhibition of aberrations of, xxxi.

Boarmia consortaria, melanic examples exhibited, xxvii.

Bolivar, Señor I., elected Honorary Fellow, xiii.

Brauer, Herr F. M., notice of death of, xiii.

Brenthidæ, exhibition of specimens of, bearing Acari, l.
British Columbia, butterfly-hunting in, xiii.
Buprestidæ, on the coloration of some, liii.
Butterflies facing sun when at rest, xxx.
Butterfly-destroyers in South China, 5.
Canada, butterfly-hunting in, xiii.
Carabus morbillosus, exhibition of a series of, to show its variability, lxv.
Catocala nupta, melanic specimen exhibited, xlv.
Catopsilia florella, on the scent of, lv.
Ceraphroninæ, hermaphrodite specimen of, exhibited, lxv.
Ceratopterus stahli, exhibited, xviii.
Cerostoma asperella from Leominster, exhibited, lxvii.
Ceuthorrhynchus contractus var. *pallipes*, from Lundy Island, exhibited, xlvi.
Ceylon, on Butterflies observed during a tour through, 61.
Chalcididæ, on a specimen of, parasitic on *Dalader acuticosta*, 55.
Chamæsyrphus scævoides, exhibited, xlvii.
Cherry-laurel, leaves of, attacked by fungus, resembling spots on wings of *Kallima*, xxxii.
China, on Butterfly-destroyers in South, 5.
Chærocampa osiris, superstitious dread of the larva of, xxiii.
Cicadidæ, additions to the knowledge of the, xiii, 191.
Coleophora, exhibition of imagines of species of, and of leaves showing the mines made by the larvæ of, xlvii.
Coleoptera, the blind Coleoptera of Australia and Tasmania, xlviii; exhibition of specimen of, showing device for cross-fertilization of flowers, lxi.
Colias edusa, exhibition of a series bred from *C. edusa* var. *helice*, vi.
,, *electra*, on the scent of, lvi.
,, *philodice*, on the resting habit of, xxix.
Collyris emarginatus, larvæ of, exhibited, lxxii.
Cordylomera suturalis, exhibition of larvæ taken from mahogany, and of a perfect insect of, xlv.
Council for 1906, nomination of, lx, lxv.
Crenis boisduvalii, exhibition of and remarks upon, xv.
Criocephalus, revision of the genus, iv, 145; *C. ferus*, on the habits of, iv, 165; *C. polonicus*, on the life history and longevity of, iv.
Cynorrhina fallax, occurrence of, at Nethy Bridge, xlvii.
Cyria imperialis, with supernumerary legs, exhibited, lxvii.
Dacne fowleri, from Bradfield, exhibited, liv.
Dalader acuticosta, on the egg and early larval stages, and on the Hymenopterous parasite of, 55.
Dasydia tenebraria var. *wockearia*, taken in company with *Erebia alecto* var. *nicholli*, exhibited, xviii.
Delias, exhibition of species of, lxvii.
Depressaria emeritella, exhibition of unique British specimen of, lxvii.
Didineis lunicornis, without wings, exhibited, lxv.
Dinoderus ocellaris, exhibition of the type specimen of, and remarks upon, xxvii.
Diploptera collected in Algeria, lxiv, 399.
Diptera, exhibition of synaposematic, xii.
Douglas, J. W., donation to the Society of a photograph of the late, xlix.

Dytiscus, on the longevity of, iv.
Erebia, exhibition of specimens of various species of, taken in the Pyrenees, xlix.
„ *alecto* var. *nicholli*, taken in company with *Dasydia tenebraria* var. *wockearia*, exhibited, xviii.
„ *gorgone* and *Erebia goante*, resemblance between, xlix.
„ *lefebvrei*, on the clasps of, xlix.
„ *melas*, exhibited, xviii; on the clasps of, xlix.
„ *palarica*, association of, with *E. evias*, in Spain, 37.
„ *stygne*, melanic specimen, exhibited, lii; association of, with *E. evias*, in Spain, 37.
Eronia cleodora, on the scent of, lvii; on variation in, lxvi.
Eucheira socialis, exhibition of the social web, pupal shells and perfect insects of, xix.
Euchloë euphenoides, on the resting habit of, lxxv.
Fellows, election of, v, xiii, xxvi, xxx, xlv, xlviii, lii, lx, lxiv.
Forficula auricularia, with abnormal cerci, exhibited, liii, lxi.
Fry, A., bequest of his collection of Coleoptera to the British Museum, xiv.
Galerucinæ, descriptions of new African, lxxvi.
Ganglbauer, Herr L. von, elected Honorary Fellow, xxx.
Genitalia of Noctuid Moths, drawings and slides of, exhibited, xvii; on the value of the, for the purpose of distinguishing species, xvii; on the variability in Lepidopterous, xxxiv.
Geographical affinities of Japanese Butterflies, xli.
Gerydus chinensis, the life history of, l.
Glutophrissa saba, on the absence of scent in, lix.
Gnorimus nobilis, exhibited, xxxi.
Gonepteryx, on scents in the male, xxxv; exhibition of several forms of, xxxvi.
„ *rhamni*, resting on underside of bramble leaves, lxxv.
Goniodoma limoniella, exhibition of the larvæ and their cases of, xlviii.
Grammoptera ruficornis, melanic specimen of, exhibited, xvii.
Guatemala, exhibition of insects from, liii.
Halticinæ, descriptions of new African, lxxvi.
Hammerschmidtia ferruginea, exhibition of British specimens of, xlvii.
Haworth, exhibition of specimens labelled by, lxvii.
Heliconius, exhibition of a series of species of, showing variation in colour, li.
Heliotropism in *Pararge* and *Pyrameis*, xxviii.
Helophilus transfugus, exhibited, lxv.
Helops striatus, with abnormal antenna, exhibited, vi.
Hemerophila abruptaria, exhibition of series to show effects of heredity, lxiii.
Hemiptera, description of two new species from Spain, v.
Heriades fasciatus, type-specimen, exhibited, lii; on the coloration in, liii.
Hermaphrodite specimen of Spilomicrinæ, exhibited, lxv.
Heteroxynis, on the matrivorus habit of, iv, 177; exhibited, v.
Heterosternus rodriguezi, exhibited, liii.
Honorary Fellows, election of, xiii, xxx, lxiv.
Hybernia defoliaria, exhibited, iii.
Hydrotæa pilipes, exhibition of both sexes of, vii; *H. tuberculata*, specimens captured in Britain, exhibited, vii.
Hymenoptera, exhibition of synaposematic, xii.

Hymenoptera-Aculeata, collected in Algeria, lxiv, 399.
Hystrichopsylla talpæ, exhibited, xxvii.
Illaphanus stephensi, exhibited, xlviii.
India, on butterflies observed during a tour through, 61.
Japan, on the geographical affinities of butterflies of, xli.
Kallima, spots on wings of, resembling leaves attacked by fungus, xxxiii.
Læmophlæus monilis, from Berkshire, exhibited, liv.
Larva of *Chærocampa*, superstitious dread of, xxiii.
Lasiocampidæ, on new African, in the British Museum, xliv, 313.
Lepidoptera, from New Zealand, v, 219; on the variability in the genitalia of, xxxiv; exhibition of a collection of, from Majorca, li; on a Lepidopterous parasite from Queensland, lii; on a collection of, made in Marocco, lii, 369.
Lifu, on Rhynchota from, xliv, 327.
Limnas chrysippus and *Pseudacræa poggei*, the numerical proportion of mimic to model, xxvi, 263.
Lochmæa suturalis, malformed specimen, exhibited, xxxi.
Lundy Island, exhibition of Coleoptera taken on, xlvi.
Lycæna, exhibition of specimens of various species of, taken in the Alps, xlix.
„ *argus* var. *hypochiona*, taken on North Downs, exhibited, xlvi.
„ *argyrognomon*, from Rhone Valley, exhibited, xlvi.
„ *melanops* var. *wheeleri*, exhibited and described, ii.
Lygæidæ, specimen of, exhibited, l.
Lymexylon navale, from the New Forest, exhibited, xlvi.
Majorca, exhibition of a collection of Lepidoptera from, li.
Malachius barnevillei, taken in Norfolk, exhibited, iv.
Marocco, on a collection of butterflies and moths made in, lii, 369.
Medon castaneus, exhibited, xxvii.
Megalopus melipona, exhibited to show its resemblance to a bee, xviii.
Megalyra, on a new species of, lx, 395.
Melanargia lachesis var. *caniyulensis*, exhibited, li.
Melanism in *Tephrosia* and *Boarmia*, xxvii; in *Catocala nupta*, xlv; in *Erebia stygne*, lii.
Melanophthalma distinguenda, from Lundy Island, exhibited, xlvi.
Melitæa aurinia var. *iberica*, exhibited, lii.
Mesosemia eumene, exhibited, ii.
Microdon latifrons, taken at Nethy Bridge, exhibited, xlvii.
Microlepidoptera, on three new genera of, xiii, 245.
Mimetica, exhibition of specimen of, liii.
Mormolyce, larvæ of, exhibited, lxxii.
Morpho adonis, a female, exhibited, xviii.
Mylothris, on the scents of species of, lviii.
„ *agathina*, on the scent of, and exhibition of alcoholic extracts of the wings of, liv.
Myrmeleon formicarius, larva, cocoon, and imago, exhibited, xlvi; exhibition of diagram of instars and mouth parts of, lxxvi; on the emergence of, lxxvi.
Natal, exhibition of butterflies from, xiv.
Neoclytus erythrocephalus, taken from the trunk of an ash tree, exhibited, xvi.

New Britain, on Rhynchota collected in Birara and Lifu, xliv, 327.
New Zealand, on Lepidoptera from, v, 219.
Noctuid Moths, drawings and slides of the genitalia of, exhibited, xvii.
Notodonta ziczac and *N. dromedarius*, hybrid between, exhibited, iii.
„ *ziczac* var., exhibited, iii.
Nymphalidæ, from N. China, apparently mimetic of *Hypolimnas misippus*, exhibited, xiii.
Obituary. Henri F. de Saussure; Rev. Francis Augustus Walker; Alexander Fry, v; Alpheus S. Packard; Alfred Beaumont, Alfred Preudhomme de Borre, xvii; Col. L. H. L. Irby, xxx; John William Douglas, George Bowdler Buckton, xlv; Capt. Frederick Wollaston Hutton, lx.
Odontopera bidentata ab. *nigra*, exhibited and remarked upon, lxvi.
Officers for 1906, nomination of, lx, lxv.
Ogyris, monograph of the genus, xxvi, 269.
Oligota granaria, exhibited, ii.
Omophlus betulæ, taken at Covent Garden, exhibited, xxxi.
Ornithoptera chimæra, with ringed body, exhibited, lxvii.
Orthoptera, exhibition of a specimen of, resembling a dead leaf, liii.
Oxypoda sericea, taken in Dulwich Wood, exhibited, v; *O. nigrina*, exhibited, v; *O. exigua*, exhibited, v.
Panorpa cognata, exhibited, iv.
Pantodinus klugi, exhibited, liii.
Panurgus moricei, exhibited, lii.
Papilio hesperus, exhibition of specimens from Entebbe with unbroken tails, xii.
„ *macleayanus*, exhibition of specimens to illustrate the use of directive markings, xviii.
Pararge, heliotropism in, xxviii.
Parasitic Lepidopteron from Queensland, lii.
Phaneroptera quadripunctata, from Chester, exhibited, li.
Photography, on the three-coloured process of, xxx.
Phycochus graniceps and *P. sulcipennis*, exhibited, xlviii.
Pierida, on the resting habit of, xxix; exhibition of African specimens of, liv, lxi, lxvi; on the scents of, liv.
Pieris napi, on resemblance of, to flower of *Leucojum*, lxxv.
„ *rapæ*, on the resting habit of, lxxiii.
Pinacopteryx, on the scents of species of, lviii; on variation in, lxvi.
„ *pigea*, exhibition of, and remarks upon, xv.
Plusiotis adelaida, exhibited, liii.
Prionocyphon serricornis, perfect insects and larva, exhibited, liv.
Pseudacræa poggei and *Limnas chrysippus*, the numerical proportion of mimic to model, xxvi, 263.
Pseudophyllidæ, exhibition of a specimen of, xxxi.
Psychoda sexpunctata, on the structure and life history of, xxx, 293.
Psylliodes luridipennis, from Lundy Island, exhibited, xlvi.
Ptinus pusillus, from Edmonton, exhibited, lxv.
Pupæ, vitality of when submerged in water, xxiii.
Pyrameis atalanta, bred in winter, exhibited, xi; on the white spot on specimens of, xii; heliotropism in, xxviii.
Rhodesia, on new species of Lepidoptera from Northern, 251.
Rhopalocera, contribution to the knowledge of African, lx.

Rhynchota, collected in Birara and Lifu, New Britain, xliv, 327.
Sarawak, exhibition of insects from, l.
Saturnia, cocoons and perfect insects of hybrid species of, exhibited, vii.
Satyridæ, descriptions of new S. American, xiii, 185.
Satyrus semele, exhibited, xviii.
Scents, in the male of *Gonepteryx*, xxxv; of African *Pieridæ*, liv; in various insects, lix.
"Season," on the word as applied to forms of insects, lxiii.
Selenia bilunaria, on the resting habit of, xxix.
Spain, entomological excursion to, v, 37; description of two new species of Hemiptera from Spain, v.
Spilomicrinæ, hermaphrodite specimen of, exhibited, lxv.
Stenobothrus, exhibition of specimens taken in Spain, mostly with mutilated wings and elytra, xvi.
„ *rufipes*, exhibited, xlvi.
Stenopteryx hirundinis, exhibited, lxvi.
Stenus ossium var. *insularis*, from Lundy Island, exhibited, xlvi.
Strawberry, leaves of, attacked by fungus, resembling spots on wings of *Kallima*, xxxii.
Synchloë hellica, on the scent of, lix.
Tæniocampidæ, on the dissimilarity in genitalia of, xvii.
Tasmania, the blind Coleoptera of, xlviii, 365.
Tephrosia consonaria ab. *nigra*, exhibited, xxvii.
Teracolus, on the scents of various species of, lvi; exhibition of African species of, lxi; on variation in, lxvi.
,, *annæ*, exhibition of, and remarks upon, xv.
,, *auxo*, exhibition of, and remarks upon, xv.
Thais, on the pupal suspension of, v, 203.
Tortrix pronubana, exhibition of, and on its occurrence in England, lxiii.
Tryphæna comes, exhibition of three generations of, lxvii.
Tryphonides schizodonti, on the group, lxxvi, 419.
Vanessa antiopa, exhibited, xviii.
Vice-Presidents, nomination of, ii.
Vitality of Pupæ submerged in water, xxiii.
Walker, Commander J. J., degree of M.A. conferred upon, xlv.
Xenarthra cervicornis, exhibited, xxvi.
Zegris eupheme, on the resting habit of, lxxv.
Zonosoma pendularia, pupa cases of, exhibited, to show the variation in the position of the silken girth, xxxii.

SPECIAL INDEX.

The Arabic figures refer to the pages of the 'Transactions'; the Roman numerals to the pages of the 'Proceedings.'

abbreviata (Enithares), 339
abd-el-kader (Satyrus), 375
abdominalis (Telephorus), 45
abdominator (Homoporus), 427, 433
abeillei (Phytocoris), 50
abietaria (Boarmia), 388
Abisara, 94
Abraxas, 130
abrota (Ogyris), 269, 271, 273, 281, 284, 289, 290, 292
abruptaria (Boarmia), 388
,, (Hemerophila), lxiii
absinthii (Siphonophora), 434
acaciæ (Thecla), 378
Acanthaspis, 110
aceris (Neptis), 95, 96, 98, 99
Acheróntia, 386
achine (Teracolus), lvi, lxii
Acidalia, li, 389
Acræa, 265
acræida (Lymanopoda), 188
acræina (Erikssonia), 255
Acridium, iv
Acrobasis, 392
Acrognathus, xxxi
Acronycta, 384
Acropteris, 97
actæa (Satyrus), 41, 42, 375
actæon (Adopæa), 41, 380
acte (Ticherra), 97
Actobius, 44
aculeata (Mordella), 45
acuminata (Ælia), 52
,, (Gonepteryx), xxxviii, xxxix
acuticosta (Dalader), 55-59
Acylophorus, 51
adelaida (Plusiotis), liii
Adelphocoris, 50
adherbal (Lycænesthes), 253
adippe, var. chlorodippe (Argynnis), 41, 42
adippe, var. cleodippe (Argynnis), 41, 42
admixtalis (Bradina), 71
Adonia, 50
adonis (Morpho), xviii
Adopæa, 41, 380
adreptella (Heterocrossa), 235
Adrisa, 358
adustum (Anthobium), 44
ægeria (Pararge), xxviii, 66, 135
ægon (Lycæna), xliii, xlvi
ægyptium (Acridium), iv
Ælia, 50, 52
æneicollis (Corœbus), 49
æneus (Paracymus), 51
,, (Saprinus), 44
ænone (Ogyris), 269, 272, 287, 289
æquilineata (Docirava), 68
Æschines, 343
æthiops (Erebia), 11
æthonellus (Crambus), 224
affine (Megymenum), 354
affinis (Pterochilus), 405
Agabus, 48, 51
Agalope, 65, 68
agamemnon (Papilio), 8, 118, 124
Agapophyta, 354
Agathidium, liv, 48
agathina (Agrotis), lxi
,, (Mylothris), liv, lviii, lix
ageliella (Depressaria), 433
aglaia (Argynnis), 40, 42, 112
,, (Delias), 8
aglaope (Ganoris), 137
Agonoscelis, 355
agrestis (Criocephalus), 158, 160, 167
Agrion, xxxi
Agrotis, li, lxi, 81, 382
akbarella (Oligochroa), 71, 79
Alæna, 252

albicinctus (Homoporus), 432
albicoxa (Promethus), 429, 436
albida (Oreopsyche), 391
,, var. lorquiniella (Oreopsyche), 391
albitarsella (Coleophora), xlvii
albithorax (Priocnemicoris), 352
,, var. patricius (Priocnemicoris), 352
albofasciatus (Phytocoris), 50
albolineatum (Ancyrosoma), 52
albomaculata (Lymanopoda), 188
albonotata (Pedaliodes), 189, 190
albosignatus (Bassus), 425, 431
alceæ (Carcharodus), 41, 381
alciphron, var. gordius (Chrysophanus), 378
alcon (Lycæna), iii
alcyonipennella (Coleophora), xlvii
alecto (Erebia), xlix
,, var. nicholli (Erebia), xviii, xlix
Aleochara, 44
aletis (Hypercallia), 235
algeriensis (Psiloglossa), 400
algira (Ophiusa), 384
ali (Hesperia), 381
alienum (Cryptostemma), 50
alluaudi (Umjaba), 196, 197, 202
almana (Precis), 72, 74, 76, 78, 84, 88, 89, 100, 109, 120, 133, 134, 139, 140, 141, 142, 143
alpestris (Lionotus), 414
,, (Odynerus), 414
alpinus (Homoporus), 426, 432
alternans (Baptolinus), 48
althææ (Carcharodus), 381
alticola (Cosmopsaltria), 200
alveus (Hesperia), 41, 381
Amara, xvi, 42, 43
amaryllis (Ogyris), 272, 285, 287, 289, 291, 292
amatus (Teracolus), 142
,, var. modestus (Teracolus), 107
Amblypodia, xliii
amen (Oncocephalus), 340
amenaida (Pentila), 252
amenena (Hypercallia), 236
Amicta, 40
amictus (Antholinus), 45
amine (Zeritis), 252
ammios (Trichodes), 49
Ammœcius, 43, 44, 48
Amphidasys, vi
Amphipyra, 384
Ampittia, 119
Amygdaloptera, 387
amymone (Crastia), 137
amymone (Euploea), 5
amyoti (Cletus), 351
,, (Gonocerus), 351
anadema (Lycænesthes), 258, 262
Anadiasa, 314, 326
anæma (Borkhausenia), 241
Anaitis, 388
analis (Euptychia), 185, 190
,, (Pompilus), 81
anastrella (Trachypepla), 237
anaura (Castalius), 95
Anchomenus, 43
Ancistrocerus, 409, 410
Ancyrosoma, 52
angustalis (Cledeobia), 41
angustatus (Esolus), 47, 48
angustior (Hoplopus), 408
,, (Odynerus), 408
angustus (Emblethus), 46, 50
Anisoplia, 44
Anisorrhynchus, 45
Anisoscelis, 352
annæ (Teracolus), xv, lvi, lxi
annulatus (Bassus), 425, 431
anomalus (Phthorimus), 420, 430, 436
Anommatus, 367
Anopheles, 110, 114, 306
ansorgei (Iridopsis), 254
Antestia, 355
Anthaxia, 49, 51
antherinus (Anthicus), 45
Anthicus, 45
anthobia (Amara), xvi
Anthobium, 42, 44
Antholinus, 45
Anthophagus, 42, 44
antinorii (Uranothauma), 253
antiopa (Vanessa), xviii, xxix, 72, 136
antonia (Gonepteryx), xxxvii
aoris (Cirrochroa), 97, 98
Apatura, xviii, xliii, 117
Aphantopus, 40
Aphanus, 46, 50, 346
Aphnæus, 85, 90, 252
Aphodius, 43, 44, 48
apiarius (Trichodes), 49
apicata (Acanthaspis), 110
Apion, l, lxv, 45, 49
apollo (Parnassius), 40
Apopestes, 385
Aporia, xxi
appiades (Euthalia), 95
Appias, 76, 139
Apterygida, xxxi
apulia (Lymanopoda), 188
aquaticus (Notiophilus), 42, 43
arachidis (Apterygida), xxxi

Aradus, 50, 342
Araschnia, xxiv
arcanioides (Cœnonympha), 376
arcanius (Cœnonympha), 40, 42
arcas (Lycæna), iii
Arctia, 381
arcolatus (Perileptus), 43
,, (Promethus), 435
areste (Arhopala), 94
argia, var. similis (Zizera), 83
argiades (Lycæna), xliii, 39, 41
,, var. parrhasius (Everes), 133
Argina, 84
argiolus (Cyaniris), 41, 67, 380
,, (Lycæna), xliii
argus (Lycæna), xliii, xlvi
,, var. hypochiona (Lycæna), xlvi
Argynnis, xlii, xliii, 40, 41, 42, 65, 66, 68, 69, 73, 74, 81, 83, 97, 98, 102, 112, 113, 128, 132, 134, 374
Argyresthia, xlvi
Argyria, 226
argyridana (Hiposcritia), 94
argyrognomon (Lycæna), 42
Arhopala, 94, 95, 97
ariadne (Ergolis), 89, 92, 109, 115, 119, 127
Arictus, 342
arion (Lycæna), ii, iii, 41
aristolochiæ (Papilio), 78, 83, 90, 99, 100, 103, 105, 106, 107, 108, 109, 111, 114, 118, 123, 133, 134
armatissimus (Polydidus), 339
armatum (Agrion), xxxi
Aromia, 43, 45
arrogans (Scutellera), 359
Artaxa, 71
artemisiæ (Heterogaster), 46, 50
arvensis (Carabus), 43
ascanii (Lixus), 52
Ascerodes, 234
Asclepias, lxi
asela (Crastia), 123, 125, 127, 131, 137
Asemum, iv, 145–176
ashworthii (Agrotis), xvii
,, (Noctua), xvii
aspasia (Gonepteryx), xxxviii, xxxix
asperaria (Gnophos), 388
asperatus (Criocephalus), 147, 158, 159, 160
asperella (Cerostoma), lxvii
Aspilates, 387
assimilis (Oncocephalus), 340
Astacops, 348
Astemma, 345
asteric (Precis), 133
astola (Neptis), 68, 81, 82, 94, 95, 97, 99
astrarche (Lycæna), 41, 42, 379
,, var. calida (Lycæna), 380
asturiensis (Otiorrhynchus), 42, 45
,, (Timarcha), 46
,, (Zabrus), 44
Asura, 129
atalanta (Pyrameis), xi, xii, 65, 373
Atella, 65, 68, 70, 74, 76, 89, 100, 103, 104, 115, 129
ater (Geocoris), 46
aterrimus (Pterochilus), 403
athaliæperda (Bassus), 437
athamas (Charaxes), 98
Atheta, 48
Athous, 42, 45
Athyma, 66, 68, 73, 81, 95
atlantica (Lymantria), 386
atlanticaria (Boarmia), 388
atlites (Precis), 89, 125, 133, 140, 143
atomarium (Apion), 49
atra (Hispa), 50
Atractomorpha, 102
atricornis (Riptortus), 351
atropos (Acherontia), 386
,, (Ancistrocerus), 409
,, (Odynerus), 409
Attelabus, 49
attenuata (Strangalia), 43, 45
atticus (Tagiades), 114
atymnus (Loxura), 90, 92
,, var. arcuata (Loxura), 126
Aufidus, 332, 363
Augiades, 42
augias (Telicota), 79, 83, 85
Aulocera, 64, 68, 69, 135
aumonti (Carabus), lxv
auraria (Vespa), 72
aurata (Zygæna), 391
aureocincta (Callidea), 359
auricularia (Forficula), liii, lxi
,, var. forcipata (Forficula), lxi
aurinia, var. iberica (Melitæa), lii
auritus (Exochomus), 50
aurolimbata (Orgyia), 41
australis (Cimex), 352
,, (Criocephalus), 158, 159
auxo (Teracolus), xv, xvi, xxxviii, lvi, lxii
avellanæ (Orchestes), 49
azrael (Physoderus), 339
Badacara, 112
badia (Metachrostis), 79
badiipennella (Coleophora), xlvii
badium, liv
bætica (Anisoplia), 44
,, (Lycæna), 81, 111

bæticus (Polyommatus), 65, 71, 72, 74, 77, 85, 105, 106, 108, 109, 131, 134
Bæturia, 329, 330
bajulus (Hylotrupes), 51, 172
balanica (Yphthima), 72, 139
Balaninus, 49
baldus (Yphthima), 114
ballus (Thestor), 378
balteatus (Syrphus), 432, 433
bambusæ (Telicota), 6, 90
banksii (Scutellera), 360, 362
,, (Tectocoris), 360
Baptolinus, 48
Baracus, 130, 132
barbarus (Orthomus), 43
Baris, 42, 45
barnardi (Ogyris), 269, 272, 285, 289, 291, 292
barnevillei (Malachius), iv
Barynotus, 45
basalis (Rivula), 132
basiventris (Eurinome), 357
,, (Pentatoma), 357
basochesiata (Cidaria), 389
Bassus, 419, 420, 425, 431, 432, 436, 437, 438
batesi (Euptychia), 185
baton, var. abencerragus (Lycæna), 379
bazalus (Arhopala), 95
bejarensis (Erebia), 10, 11, 16, 17, 27, 30, 33
belemia (Euchloë), 372
Belenois, liv, lvii, lviii, lix, lxvi, 65, 67, 70, 71, 76, 78, 79, 80, 82, 103, 104, 105, 106, 107, 134, 137, 144
Bembidium, 42, 43, 48, 46, 51
benjamini (Rhopalocampta), 7
Beosus, 50
Beralade, 319–322, 326
Betarmon, 44
bettoni (Beralade), 320, 322, 326
betulæ (Omophlus), xxxi
,, (Rhynchites), 45
betularia (Amphidasys), vi
,, var. doubledayaria (Amphidasys), vi
Biblia, 108
bicinctus (Lygæus), 349
bicolor (Stenobothrus), xvi
bicornis (Hymenopus), 57
bidentata ab. nigra (Odontopera), lxvi
bidentatus (Anisoscelis), 352
,, (Lionotus), 410
,, (Lygæus), 352
,, (Odynerus), 410
Bidessus, 51
bifasciatum (Rhagium), 161, 163, 167, 168, 169
biglobosa (Hypera), 42, 45
biguttata (Tituboea), 49
biguttatus (Bassus), 419
,, (Homoporus), 427, 432
,, var. deplanatus (Homoporus), 432
,, var. rufipes (Homoporus), 432
Bilactis, 113
billiardiens (Calliphara), 362
bilunaria (Selenia), xxiv, xxv, xxvi, xxix
bimaculatus (Homoporus), 433
,, (Olibrus), 48
bioccllata (Euptychia), 187, 190
bipunctata (Agapophyta), 354
bipunctifera (Schœnobius), 110
biraræ (Phyllyphanta), 335
birarensis (Clovia), 330, 331, 363
biscutellatus (Ceuthorrhynchus), 49
bisignatus (Olibrus), 48
bispinosus (Lionotus), 413
,, (Odynerus), 413
Biston, xxxi
bituberculatus (Dolichoderus), 1
bivittatus (Telephorus), 45
bizonarius (Homoporus), 426, 432
Blanaida, 135
blanchardianus (Lionotus), 412
,, (Odynerus), 412
,, (Quiroguesia), 73
blattariæ (Cionus), 45
Boarmia, xxvii, 388
bochus (Jamides), 98
bœtica (Lampides), 41, 42
bœticus (Lampides), 379
boisduvalii (Crenis), xiv
Bolboceras, 104
bolina (Hypolimnas), 62, 70, 71, 76, 79, 82, 83, 84, 117, 125, 134
bolivari (Oncotylus), 50
boliviana (Euptychia), 187, 190
Bombus, 72, 94
Bombycia, 383
Bombycopsis, 322, 326
bombyliformis (Sesia), 109
bonvouloiri (Aphodius), 43, 44, 48
borealis (Homoporus), 426, 432
Borkhausenia, 239, 240, 241
bornemanni (Saturnia), viii
Bothrideres, 47, 48
bouvieri (Yanga), 194, 202
Brachycoleus, 50
Brachyderes, 49, 52
Brachyplatys, 362
Brachyrhynchus, 342
Brachytemnus, 49
Bradina, 71

brassicæ (Ganoris), lvi, lvii, lviii, 72
,, (Pieris), xxxii, 40, 371
,, var. cheiranthi (Pieris), 371
,, var. wollastoni (Pieris), 371
brevicollis (Meloe), 45
,, (Vesperus), 49, 51, 52
brevicornis (Homoporus), 422, 427, 434
brevitarsis (Homoporus), 426, 432
briseis (Satyrus), 374
Brotolomia, 384
brunneipennis (Pentatoma), 355
,, (Plautia), 355
brunneus (Agabus), 51
bryaula (Gymnobathra), 238
bucephala (Phalera), xxiv, 387
,, var. bucephalina (Phalera), 387
buprestoides (Spondylis), 47, 49
burmeisteri (Myodocha), 350
,, (Leptocorisa), 350
Byrrhus, 44
Bythoscopus, 334
cacaliæ (Orina), 46
cacica (Morpho), xix
cadderensis (Nematus), 438
Caduga, 95, 96
Cærois, 117
cærulea (Euptychia), 186
cærulea (Temnochila), 51
cæruleocephalus (Rhynchites), 52
cæsum (Omalium), 44
calais (Teracolus), 79, 139, 144
Calathus, 42
c. album (Vanessa), xliii, 373
calcaratus (Miris), 50
calice (Castalius), 253
calidasa (Limenitis), 129
Callidea, 359
Callidium, 158
Callidryas, xxxvii, 117
Calliphara, 362
Callophrys, 378
Callopistria, 385
Calocoris, 46
Calysime, 125
Camena, 93
Campanotus, 270
campestris (Cicindela), 43
Camptobrochis, 50
Camptopus, 52
canalensis (Heterogynis), 178, 180, 184
canescens (Pericoma), 311
canidia (Ganoris), 67, 70, 71, 72, 73, 81, 95, 97, 111, 134, 137
cantabrica (Chrysomela), 42, 46
,, (Rhagonycha), 45
cantabricus (Haptoderus), 43
Cantao, 361
capensis (Chondrostegoides), 324, 325
,, (Taragama), 315, 326
Caprona, 117, 129
Capsus, 46, 50
Carabus, lxv, 42, 43, 46, 47
Caradrina, 93
carbonarius (Hister), 44
,, (Srenus), 44
Carcharodus, 41, 381
cardamines (Euchloë), lxxv
cardioderus (Harpalus), 42, 44
cardui (Pyrameis), xii, xxix, 66, 72, 82, 94, 111, 134, 373
carinata (Lareynia), 47, 48
carinatus (Deronectes), 51
carinulatus (Bassus), 437
carnifex (Proteodes), 236
carniolica (Zygæna), 391
,, var. orana (Zygæna), 391
carnipennis (Gonepteryx), xxxvii
caroli (Hoplopus), 406
,, (Odynerus), 406
carpetanum (Bembidium), 47, 48
Carpocoris, 46, 50
carrensi (Cimex), 354
Cassida, 50
Castalius, 95, 117, 120, 133, 253
castanea (Liodes), 48
castaneus (Medon), xxvii
castilianum (Dorcadion), 45
castrensis (Malacosoma), lxix
Catacanthus, 354
catalaunaria (Tephrina), 110
cataxesta (Scoparia), 231
catharina (Ogyris), 283
Cathormiocerus, 47, 49
catilla (Catopsilia), 84, 138
Catocala, xlv, 41, 384
Catochrysops, 71, 79, 83, 85, 88, 90, 103, 108, 109, 253, 258, 259, 262
Catophaga, 111, 112, 115, 116, 123, 127, 128, 130, 134, 135, 137, 142, 143
Catopsilia, xxxvii, lv, 7, 70, 75, 79, 80, 81, 84, 88, 89, 92, 99, 101, 105, 107, 109, 110, 115, 118, 119, 121, 122, 133, 134, 138, 139, 140, 141, 142, 143, 144
caudata (Megalyra), 396
caudatus (Homoporus, 426, 432
cauta (Phylacodes), 242
cazurroi (Stenobothrus), xvii
Celænorrhinus, 95, 129
celeno (Lampides), 90, 92, 95, 98, 109, 117, 119, 120, 126, 127
,, var. alexis (Lampides), 90, 99
,, var. conferanda (Lampides), 109, 117, 120

celerio (Chœrocampa), 77, 386
Celonites, 399
cenis (Zonosoma), 96
centaurus (Arhopala), 95
Centrocoris, 50, 52
Cephalallus, 147, 148, 163
Cephalocrius, 146, 147, 149, 164
Cephanodes, 109
Ceratopterus, xviii
Cercotmetus, 342
Cerocoma, 47, 49, 52
Cerostoma, lxvii
cervicolor (Athous), 45
cervicornis, (Xenarthra), xxvi
cervina (Anadiasa), 314, 326
cespitalis (Herbula), 69
Cethosia, 125
Ceuthorrhynchus, xlvi, 45, 49
ceylonica (Nepheronia), 117, 127
,, (Parantica), 121, 123, 124, 133, 137
,, (Yphthima), 113, 114, 121, 133
chalconotus (Agabus), 51
chalybæa (Pierella), 185
Chamæsyrphus, xlvii
chambereti (Antestia), 355
,, (Strachia), 355
chamomillæ (Cucullia), 383
championi (Taphropeltus), 50, 52
charadrias (Stenoptilia), 232
Charaxes, 98, 251, 373
charina (Pinacopteryx), lviii, lxvi
charonia (Vanessa), 112, 113
chenui (Yphthima), 111, 113
chevrolati (Cathormiocerus), 47, 49
,, (Hymenoplia), 44
Chilades, 79, 83, 85, 101, 103, 119
Chilena, 319, 322
chimæra (Ornithoptera), lxvii
chinensis (Gerydus), 1–4
chionogramma (Xanthorhoe), 220
Chironomus, 293, 298, 306, 307, 308, 309, 310, 311
Chittira, 131, 137
Chlænius, 44, 47, 48
chlamydota (Scoparia), 230
chloradelpha (Borkhausenia), 239
chlorias (Xanthorhoe), 220
Chloridea, 382
Chloroclystis, 219
chloroticus (Lionotus), 410
,, (Odynerus), 410
Chœrocampa, xxiii, 77, 386
Chondrostega, 313, 323, 324
Chondrostegoides, 313, 323, 324, 325
chrysippus (Limnas), xxvi, 72, 73, 75, 78, 80, 84, 87, 89, 97, 100, 104, 105, 106, 108, 109, 113, 115, 118, 120, 123, 132, 133, 137, 263–268
,, var. dorippus (Limnas), 109, 264, 265, 266, 268
,, var. klugi (Limnas), 264, 268
Chrysocoris, 126, 359
chrysogramma (Borkhausenia), 241
Chrysomela, 42, 46, 50
Chrysophanus, 65, 66, 68, 81, 82, 378
chrysorrhœa (Euproctis), 386
chrysozona (Mamestra), 383
Cicada, 199, 328, 330
Cicindela, 42, 43
Cidaria, 67, 389
Cimex, 346, 349, 352, 354, 355, 360
cinctus (Homoporus), 426, 432
cinerea (Haplopacha), 324
cingulatus (Cimex), 346
,, (Dysdercus), 345, 346
,, (Homoporus), 432
cinnamopterus (Pilophorus), 50
Cionus, 45
Cirrochroa, 98, 125, 127, 134
Cistus, 52
Cledeobia, 41, 392
cleobis (Camena), 93
cleobule (Gonepteryx), xxxvii, xxxix
cleodora (Eronia), lvii, lxvi
Cleogene, 39
Cleonus, 45, 52
cleopatra (Gonepteryx), xxxv, xxxvi, xxxvii, xxxix, xl, xli, 373
Cleophana, 383, 384, 393
Clerus, 52
Cletus, 451
Clinteria, 72
Clovia, 330, 331, 363
clytia (Papilio), 5
cnejus (Catochrysops) 71, 79
Cneorrhinus, 46, 49
Cnethocampa, 183
c-nigrum (Agrotis), 382
coarctata (Eumenes), 400
,, var. dubius (Eumenes), 400
Coccinella, 50
Coccoteris, 357
Cochlidion, xxiv
cocksi (Salda), 50
Coctoteris, 357
cœcus (Halorhynchus), 368
Cœnonympha, xliii, lii, 24, 40, 41, 42, 376, 377, 393
cognata (Cirrochroa), 125, 127, 134
,, (Panorpa), iv
cognatus (Promethus), 429, 436

Coleophora, xlvii, xlviii
Colias, vi, xxix, xliii, lv, 40, 65, 68, 69, 72, 73, 78, 94, 112, 113, 372
Collyris, lxxii, lxxiii
comes (Agrotis), 382
,, (Tryphæna), lxvii
comma (Augiades), 42
communis (Panorpa), iv
compressus (Phthorimus), 421, 430, 436
Compsistis, 243
conchylalis (Cydalima), 100
concolor (Gynandrophthalma), 42, 45
concordia (Crenidomema), 251
confusus (Homoporus), 433
consobrinus (Hoplopus), 406
,, (Odynerus), 406
consonaria (Tephrosia), xxvii
consortaria (Boarmia) xxvii
conspersa (Bombycopsis), 322
conspersus (Agabus), 48
constrictus (Leistus), 46, 47
contactella (Heterocrossa), 235
,, (Tinea), 235
continua (Beralade), 320, 321
contracta (Catochrysops), 103
contractus (Taphropeltus), 52
,, var. pallipes (Ceuthorrhynchus), xlvi
conversa (Catocala), 41, 384
,, var. agamos (Catocala), 384
convolvuli (Sphinx), 79
cooksoni (Cyclopides), 260
,, (Erikssonia), 255, 262
,, (Mycalesis), 251, 262
Cooksonia, 256, 257, 262
Copris, 48
Coptosoma, 362
Coranus, 50
cordula (Satyrus), 26
Cordylomera, xlv
core (Crastia), 78, 83, 87, 89, 91, 100, 108, 110, 117, 123, 137
,, var. vermiculata (Crastia), 83
coreanus (Criocephalus), 153, 154, 164
coreoides (Narmada), 117
coriaceus (Criocephalus), 145, 158
Corixa, 50, 52
Corizus, 50
Corœbus, 49
corollæ (Syrphus), 432
coronillaria (Pseudoterpna), 389
corticea (Euxoa), 69
coruscans (Geotrupes), 47, 48
Corydalis, 307
corydon (Lycæna), 41
Corymbites, 42, 45
Corymica, 130
Coryphocera, 129
Cosmophila, 132
Cosmopsaltria, 200, 330
costata (Idæa), 130, 132
craccæ (Apion), 49
Crambus, 225, 226
crassicornis (Corizus), 50
crassicrus (Homoporus), 424, 428, 434
crassipes (Phymata), 50
Crastia, 78, 83, 87, 89, 91, 100, 108, 110, 117, 123, 127, 131, 137
cratægi (Aporia), xxi
,, (Pontia), xxi
crawshayi (Lycænesthes), 253
,, (Tetropium), lxvii
Creatonotus, 126,
crenæus (Crambus), 225
Crenidomema, 251
Crenis, xiv, 251
cribella (Mycleis), 392
cribraria (Argina), 84
,, (Euprepia), 381
,, var. punctigera (Euprepia), 381
crinalis (Zanclognatha), 385
crino (Papilio), 118
Criocephalus, iv, 49, 51, 145–176
cristata (Taragama), 315
cristatus (Pterostichus), 43
,, var. cantabricus (Pterostichus), 43
crocale (Catopsilia), 138
Crocisa, 92
Crocydopora, 224
Cromna, 334
Cryptocephalus, liii, 42, 45, 46, 49, 50
Cryptops, 310
Cryptostemma, 50
Cteniopus, 45
Cucullia, 383
Culex, 110, 298, 307
cuneata (Taragama), 316
Cupha, 125, 127
cupreus (Pœcilus), 43
curculionoides (Attelabus), 49
Curetis, xliii, 90, 134
cursitans (Pachytomella), 46, 53
curvatula (Drepana), xxiv, xxv
Cuspicona, 356, 357
Cyamophthalmus, 146
cyanicornis (Tachypus), 48
Cyaniris, 41, 66, 68, 69, 95, 99, 129, 130, 132, 380
cyclopicus (Crambus), 225
Cyclopides, 260, 262
cyclopius (Erebia), 13
Cydalima, 100

Cydnus, 359
Cymbalophora, 381
Cymindis, 42, 44
Cymus, 50
Cynorrhina, xlvii
Cyphodema, 50
cypris (Morpho), xix
Cyrestis, 96
Cyria, lxvii
Cyrtonus, 47, 50
Dacne, liv
dactyloptera (Triscædecia), 247
daira, var. nouna (Teracolus), 372, 393
Dalader, 55–59
damo (Ogyris), 281
Danacæa, 45
danäe (Teracolus), 119, 142
Danais, 73, 123, 131
dantici (Lionotus), 410
,, (Odynerus), 410
daphne (Argynnis), 42
daplidice (Pieris), 40, 372
Darbanus, 340
daretis (Lethe), 128, 132, 134
darsius (Ornithoptera), 123, 128
Dasychira, 132
Dasydia, xviii
Dasytes, 42, 45
davendra (Epinephele), 72
deceptor (Criocephalus), 151, 159, 164
,, (Hoplopus), 407
,, (Odynerus), 407
decorum (Bembidium), 48
defina (Lycænesthes), 253
deflexicollis (Hydrocyphon), 45
defoliaria (Hybernia), iii
degeneraria (Acidalia), li
deidamia (Pararge), xliii
Deilephila, 386
Deiopeia, 72, 81, 84, 109, 110
dejeani (Cleophana), 383
,, (Zonabris), 49
Delias, lxvii, 8, 79, 83, 84, 86, 87, 90, 91, 92, 101, 118, 123, 133, 137
Deltomerus, 42, 43
depilis (Byrrhus), 44
deplanatus (Bassus), 437
,, (Homoporus), 427, 433
Depressaria, lxvii
depressus (Aphodius), 44
Dermestes, 77
Deronectes, 47, 48, 51
desfontainii (Melitæa), lii
detersa (Enome), 108, 110
deva (Pratapa), 85, 134
devius (Microdon), xlvii
deyrollei (Carabus), 43
Diadema, 70
diana (Platylomia), 201
Diapria, lxv
Dichorrhagia, xliii
Dichotrachelus, 47, 49
Dichromodes, 222
dichrous (Melanotus), 49, 51
Dicraneura, 387
Dictyophara, 336
Dicyphus, 50
Didineis, lxv
didyma (Melitæa), 373
,, var. deserticola (Melitæa), 374
didymus (Agabus), 51
Dieuches, 110
diffluens (Cleophana), 384
,, var. maroccana (Cleophana), 384, 393
diffusa (Eupterote), 126
dilecta (Quartinia), 400
dilectus (Cyaniris), 99
dimidiatipennis (Eumenes), 105, 106
dimidiatus (Homoporus), 428, 434
Dindymus, 344, 345
Dinoderus, xxvii
diophthalmus (Tectocoris), 361
dipsacea (Chloridea), 382
Dipsas, xliii
Dipterina, 233
Diptychophora, 227
discretus (Hydroporus), 51
dispar (Lygæus), 349
,, (Lymantria), 386
,, (Oncopeltus), 349
disputaria (Tephrinia), 79, 108
dissimilis (Papilio), 5, 8, 124, 134
distans (Tagiades), 114
distincta (Anadiasa), 315
,, (Philudoria), 315
distinguenda (Melanophthalma), xlvi
,, (Taragama), 315, 326
dives (Chlænius), 47, 48
,, (Polyrrhachis), 1
dochmia (Scoparia), 229
Docirava, 68
Dodona, 82, 93
dodsi (Promethus), 421, 429, 435
Dolichoderus, 1
dolopæa (Strepsicrates), 232
dolosus (Darbanus), 340
,, (Euagoras), 340
domestica (Musca), 70
domesticus (Gryllus), 309, 311
donaldsoni (Beralade), 321
Dorcadion, 43, 45, 46, 47, 49
doria (Pachytomella), 53
dorilis (Polyommatus), 41
dorsalis (Promethus), 429, 436
dorycus (Astacops), 348

Dorylus, 100
doursii (Lionotus), 413
,, (Odynerus), 413
Drepana, xxiv
dromedarius (Notodonta), iii
drosochalca (Orthenches), 242
Dryadaula, 243, 244
dryas (Clovia), 331
,, (Satyrus), xliii
,, (Thalattoscopus), 334, 363
drypetes (Lethe), 129
duaringa (Ogyris zosine-), 280
dubia (Phyllyphanta), 335
,, (Polistes), 416
dubius (Sehirus), 50
,, (Sphindus), 47, 49
dulcis (Teracolus), 107, 142, 144
Dundubia, 330
12-guttata (Halyzia), 50
12-striatus (Anommatus), 367
duplex (Oxeoschistus), 189, 190
durga (Dodona), 82
Dynamenais, 343, 344
Dysdercus, 345, 346
Dytiscus, iv, 51
Earias, 71, 79
eatoni (Lionotus), 412
,, (Odynerus), 412
ebenina (Philia), 360
ebenista (Strophosomus), 49
Echidnoglossa, 48
echii (Monanthia), 50
Ectatops, 343, 344
edusa (Colias), vi, lv, 40, 65, 372
,, var. helice (Colias), vi, 372
egregius (Lionotus), 410
,, (Odynerus), 410
Elaphrus, 43
electra (Colias), lv
elegans (Coryphocera), 129
,, (Homoporus), 428, 435
elima (Aphnæus), 85
Elis, 88
elongaria (Acidalia), 389
elongatum (Bembidium), 51
elpis (Lampides), 95, 96
Elymnias, 88, 89, 92, 98, 115
emarginatus (Collyris), lxxii
embla (Erebia), 13
Emblethis, 46, 50
embolina (Lethe), 129
emeritella (Depressaria), lxvii
emiliæ (Saturnia), viii
Emus, 43, 44
encedon (Acræa), 265
Enicmus, 47, 48
Enithares, 339
Enome, 108, 110
Epamera, 252
Epeira, 5
Ephyra, 389
epibata (Criocephalus), 158
epicles (Ilerda), 93, 97, 134
Epinephele, xliii, 40, 42, 72, 94, 135, 376
epiphanes (Izatha), 238
epiphron (Erebia), 39, 40
Epirodera, 339
Episilia, 382
epius (Spalgis), 126
epotis (Platyptilia), 231
equestris (Amara), 42, 43
,, (Lygæus), 46, 50
erate (Colias), 73
Erebia, xviii, xliii, xlix, lii, 9–35, 39, 40, 41, 42
eremitis (Scoparia), 230
Ergates, 51
Ergolis, 89, 92, 97, 101, 109, 115, 119, 125, 127
ericæ (Ceuthorrhynchus), 45
Ericeia, 110
ericetaria (Selidosema), 388
erikssoni (Aphnæus), 252
Erikssonia, 255, 256, 262
erinaceus (Strophosomus), 49
eriopoda (Amphipyra), 384
eris (Teracolus), lvi
erithonius (Papilio), 71, 74, 78, 83, 84, 90, 100, 107, 109, 113, 116
Eronia, lvii, lxvi
erratica (Megalocerœa), 50
erymanthis (Messaras), 127
erythraspis (Pentatoma), 356
,, (Stenozygum), 356
erythrocephalus (Neoclytus), xvi
esa (Platypleura), 194
Esolus, 47, 48
esuriens (Eumenes), 85
Etiella, 108
etrida (Teracolus), 71, 80, 103, 104, 105, 106, 107, 117, 119, 134, 139, 141, 142, 144
Euagoras, 340
Eublemma, 385
eucharis (Delias), 79, 83, 84, 86, 87, 90, 91, 101, 118, 123, 133, 137
,, (Teracolus), 108, 119, 142
Eucheira, xix
Euchloë, lxxv, lxxvi, 372, 393
Euchromia, 129
Eucorysus, 359
eugenes (Dodona), 93
eukrines (Liptena), 253, 262
eumene (Mesosemia), ii
Eumenes, 85, 105, 106, 129, 400
eupheme (Zegris), lxxv

euphemus (Lycæna), ii, iii
eupheno (Euchloë), 372
,, var. androgyne (Euchloë), 372, 393
euphenoides (Euchloë), lxxv
euphrosyne (Argynnis), 102
Eupithecia, 389
Euplexia, 384
Euplœa, 5, 6, 91, 96, 124
euprepes (Iridopsis), 254, 262
Euprepia, 381
Euproctis, 386
Eupterote, 126
Euptychia, 185, 186, 187, 190
Euricania, 335
Eurinome, 357
Euripus, xliii
Eurranthis, 387
euryale (Erebia), 17, 39, 40
Eurydema, 50, 52
Eurygaster, 50
eurynome (Neptis), 5, 6
Euryphene, 251
Eurythecta, 233
Euterpe, xx
Euthalia, 77, 89, 95
Euxoa, 69, 104, 382
evanescens (Umjaba), 197
Everes, 133
evias (Erebia), 9–35, 39, 40
,, var. hispanica (Erebia), 10, 19, 27, 28, 30, 31, 34, 35
,, var. peñalaræ (Erebia), 18, 19, 31, 33, 35
exhausta (Bœturia), 330
,, (Cicada), 330
exigua (Oxypoda), v
exiguus (Coctoteris), 357
exilis (Meligethes), 51
Exochomus, 50
exoticus (Criocephalus), 155, 159, 164
exquisita (Iridopsis), 254
exultans (Bassus), 419
Eysarcocoris, 110
Eysarcoris, 357
faber (Ergates), 51
faceta (Episilia), 382
falcata (Phaneroptera), li
falcataria (Drepana), xxiv, xxv
falkensteinii (Uranothauma), 253
fallax (Cynorrhina), xlvii
famelica (Physopelta), 343
familiaris (Amara), xvi
,, (Cimex), 349
,, var. hospes (Stalagmostethus), 349
famosus (Dindymus), 344
famula (Fidonia), 387
farinosa (Gonepteryx), xxxviii, xl
fascialata (Sclidosema), 223
fasciata (Macroplax), 50
fasciatus (Heriades), lii
fasciipennis (Megalyra), 396
fausta (Teracolus), 106
favonia (Zygæna), 391
febretta (Amicta), 40
felicina (Metopoceras), 384
felicitanus (Rhizotrogus), 43, 44
femoralis (Phytocoris), 50
femorata, var. aureocincta (Philia), 359
ferruginea (Hammerschmidtia), xlvii
ferus (Criocephalus), iv, 145–176
,, (Nabis), 50, 52
,, var. hispanicus (Criocephalus), 157, 164
festivum (Eurydema), 50, 52
festivus (Homoporus), 435
,, (Promethus), 429, 436
fettigi (Cœnonympha), 376
fibulata (Idæa), 108
Fidonia, 387
fidoniata (Semiothisa), 79
fieldii (Colias), 65, 68, 69, 73, 77, 134
fimbriata (Physopelta), 343
fischeri (Celonites), 399
fissorius (Homoporus), 427, 433
flagellatus (Gymnopleurus), 48
flammatra (Agrotis), 81
Flata, 335
flavalis (Pyrausta), 392
flaviceps (Geocoris), 349
,, (Priocnemicoris), 352
flavicornis (Aradus), 50
,, (Paromalus), 47, 48
,, (Rhamphus), 49
flavipes (Hydrophilus), 51
,, (Hydroporus), 48, 51
,, (Oniticellus), 48
,, (Trichomastix), 425, 430
flavolineatus (Homoporus), 427, 433
flegyas (Abisara), 94
,, (Zemeros), 95, 97
florale (Omalium), 44
florella (Catopsilia), lv
floricola (Lionotus), 414
,, (Odynerus), 414
fluviata (Plemyria), 132
fœderata (Polistes), 416
fœtens (Aphodius), 44, 48
fontenayi (Leptura), 43, 45
Forficula, liii, lxi
formicarius (Clerus), 52
,, (Myrmeleon), xlvi, lxxvi
formosa (Imogen), 338
,, (Peggioga), 336, 363
formosus (Cyclopides), 260

fornicatus (Hajar), 336
fossor (Aphodius), 44
fowleri (Dacne), liv
fracticornis (Onthophagus), 44
franconica (Malacosoma), 391
fraterculus (Promethus), 436
frigidus (Ammœcius), 43, 44, 48
frontalis (Homoporus), 432
,, (Ploteia), 132
frugaliata (Semiothisa), 104
fuligineus (Stygnocoris), 46
fuliginosus (Ilybius), 51
fulvipes, var. varipes (Philonthus), 44
fumata (Chittira), 131, 137
fumosa (Beralade), 320
funerarius (Bombus), 94
furcatus (Onthophagus), 44
fusca (Taragama), 316, 326
fuscipes (Aleochara), 44
,, (Hydrobius), 51
fuscus (Rhizotrogus), 43, 44
fylla (Abisara), 94
galathea (Melanargia), lii, 39, 40
galba (Hesperia), 106
gamma (Plusia), 385
Ganoris, lvi, lvii, lviii, lix, 67, 70, 71, 72, 73, 81, 87, 91, 95, 97, 99, 101, 111, 134, 137
garuda (Euthalia), 77, 89
Gastrimargus, 83
Gastroidea, 46
Gastroplakæis, 314, 326
Gegenes, 73, 74, 76
geminata (Zonabris), 49, 52
geminus (Bidessus), 51
gemmaria (Boarmia), 388
geniculatus (Dicyphus), 50
,, (Halorhynchus), 368
genistæ (Rhagonycha), 45
genoveva (Ogyris), 270, 271, 278, 280, 286
,, -duaringa (Ogyris), 271
,, -magna (Ogyris), 271
genutia (Danais), 73
,, (Limnas), 87, 89, 90, 91, 92, 98, 100, 104, 105, 109, 123, 138
Geobia, 358
Geocoris, 46, 349, 363
Geodromicus, 47, 48
geometralis (Lepyrodes), 95
geometrica (Grammodes), 385
Geotomus, 358, 359
Geotrupes, 43, 44, 47, 48
germanica (Panorpa), iv
,, (Vespa), 417
germari (Apion), lxv
Gerris, 52, 341
Gerydus, 1–4
geryon (Procris), 41
gesticularia (Thamnonoma), 388
ghilianii (Carabus), 46, 47
,, (Steropus), 46, 48
gibbifer (Gerris), 52
gideon (Xylotrupes), 132
gidica (Belenois), lvii
glabra (Liodes), 48
glabrata (Echidnoglossa), 48
glabricollis (Acylophorus), 51
glaciale (Bembidium), 42
glacialis (Erebia), xviii
,, (Helophorus), 44, 48
,, var. nicholli (Erebia), 9
glandicolor (Cymus), 50
glauca (Catochrysops), 253
glaucescens (Tarundia), 335
glaucicolella (Coleophora), xlviii
glaucippe (Hebomoia), 116, 126
globicollis (Cryptocephalus), 50
Glottula, 383
Glutophrissa, lix
glycinopa (Dryadaula), 243, 244
gnoma (Catopsilia), lv, 138
Gnophos, 388
Gnorimus, xxxi
goante (Erebia), xlix
goeldii (Pachypodistes), 245, 246
Gonepteryx, xxxv–xli, 64, 66, 80, 372, 373
Goniodoma, xlviii
Gonocerus, 50, 351
Gonometa, 313, 326
gordius (Polyommatus), 41, 42
gorge (Erebia), xlix
gorgone (Erebia), xlix
gorgopis (Tauroscopa), 227
goschkevitschii (Blanaida), 135
gothicus (Lopus), 50
graberi (Taragama), 316
gracilentus (Promethus), 436
graculus (Homoporus), 426, 432
graellsi (Dichotrachelus), 47, 49
,, (Dorcadion), 49
Grammodes, 385
Grammoptera, xvii
granaria (Oligota), ii
grandidieri (Yanga), 195, 202
grandis (Pterochilus), 404
,, (Scutellera), 359
graniceps (Phycochus), xlviii, 367
Graphosoma, 50
Grapta, xxix, xliii, 136
gremius (Suastus), 87, 109
griseata (Dichromodes), 222
,, (Œcophora), 239, 240
griseostriatus (Deronectes), 47, 48
Gryllotalpa, 1
Gryllus, 309, 311

guadarramus (Carabus), 46, 47
guttatus (Agabus), 48
guttigera (Eysarcocoris), 110
guttularis (Yanga), 196
guynemeri (Stenus), 42, 44
Gymnobathra, 238
Gymnopleurus, 48
Gynandrophthalma, 42, 45
Gyrinus, 51
hæmatodes (Corymbites), 42, 45
hæmoptera (Chrysomela), 46, 50
hæmorrhoidalis (Aphodius), 44
Hajar, 335, 336
halensis, var. fuscitarsis (Hydroporus), 51
halmaturia (Ogyris), 269, 271, 275, 276, 277, 289, 290, 292
Halorhynchus, 368
Haltica, 46
Halyzia, 50
Hammerschmidtia, xlvii
hamza (Adopæa), 380
hannibal (Lionotus), 414
,, (Odynerus), 414
hapalina (Catochrysops), 109
Haplopacha, 313, 323, 324
Haptoderus, 43, 46, 48
hardwickii (Parnassius), 69
Harmologa, 234
harmonia (Ueana), 329, 363
haroldi (Mycalesis), 252, 262
Harpactor, 46
Harpalus, 42, 44
harpophorus (Crambus), 235
Hebomoia, 98, 116, 126
hebræus (Polistes), 73
hecabe (Terias), 61, 66, 67, 68, 70, 71, 72, 73, 75, 79, 81, 82, 83, 84, 87, 89, 95, 98, 99, 109, 111, 113, 119, 121, 122, 129, 130, 132, 134, 139, 140, 141, 142, 143, 144
hector (Papilio), 114, 118, 123, 134
helena (Morpho), xix
helenus (Papilio), 7
helice (Colias), vi
Heliconius, li, 117
Heliopates, 45
Heliothis, 41
hellenicus (Pterochilus), 406
hellica (Synchloë), lix
helluo (Carabus), 46, 47
Helochares, 51
Helophilus, lxv
Helophorus, 42, 44, 47, 48
Helops, vi
Hemerophila, lxiii
hemiclista (Dipterina), 233
Henicopus, 43, 45
Henicospilus, 110
Hepialus, 41
Herbula, 69
Heriades, lii, liii
hespera (Nephele), 71, 77
Hesperia, 41, 381
hesperica (Rhagonycha), 45
hespericus (Anisorrhynchus), 45
hesperus (Papilio), xii
Hestia, 133
heteraulus (Crambus), 224
Heterocordylus, 46
Heterocrossa, 235
Heterogaster, 46, 50
Heterogynis, iv, 41, 177–184
Heterosternus, liii
hewitsoni (Ogyris), 269, 270, 272, 285, 289, 291, 292
,, -meridionalis (Ogyris), 272, 286, 289
heydeni (Agabus), 48
,, (Henicopus), 43, 45
hieracii (Zonabris), 49
Hierodula, 6
hintza (Castalius), 253
Hiposcritia, 93, 94, 95, 111, 112, 141
Hipparchia, 73, 74, 135
hippia (Nepheronia), 88, 90, 107
hippo (Tachyris), 97, 99, 141
hippothoe (Polyommatus), 42
hirtarius (Biston), xxxi
hirtus (Emus), 43, 44
hirundinis (Stenopteryx), lxvi
Hispa, 50
hispanica (Erebia), 12, 17, 27, 28, 29, 30, 38
,, (Isomira), 45
hispanicum (Dorcadion), 49
hispanicus (Bassus), 436
Hister, 44
histrio (Crocisa), 92
hobleyi (Lycænesthes), 258
holmgreni (Zootrephus), 425, 430, 431
Homapterus, 42, 45
homeyeri (Liptena), 252, 262
,, (Spindasis), 255
Homaporus, 422, 423, 424, 425, 426, 432, 433, 434, 435
honestus (Harpalus), 44
Hoplopus, 406, 407, 408
horæa (Borkhausenia), 240
horsfieldi (Mimela), 98
hospes (Lygæus), 349
Hotinus, 126
hova (Rihana), 198
hübneri (Yphthima), 87, 88, 89, 92, 113, 134, 142
humeralis (Dacne), liv

humeralis (Liodes), 48
Huphina, 66, 70, 79, 91, 94, 96, 98, 99, 101, 102, 105, 106, 115, 119, 120, 127, 137, 139, 140, 141, 142, 143, 144
hyale (Colias), xliii, 40
,, var. erate (Colias), 72
hyalina (Agalope), 65, 68
,, (Sadaka), 191
Hybernia, iii
Hyblæa, 83
hybridalis (Stenopteryx), 112, 113
Hydræna, 48, 51
Hydrelia, 109
Hydrobius, 51
Hydrochus, 51
Hydrocyphon, 45
Hydrophilus, 51
Hydroporus, 47, 48, 51
Hydrotæa, vii
hygrobius (Homoporus), 429, 435
hylas (Cephonodes), 109
,, (Lycæna), 41, 380
,, var. atlantica (Lycæna), 380, 393
Hylastes, 49
Hylotrupes, 51, 172
Hylurgus, 51
Hymenia, 71, 77, 85
Hymenoplia, 44
Hymenopus, 57
hyoscyami (Therapha), 46, 50
Hypanis, 108, 119, 142
Hypena, 67, 386
Hypera, 42, 45
hyperanthus (Aphantopus), 40
,, (Epinephile), 135
Hypercallia, 235
hyperion (Anfidus), 332, 363
Hypocista, xviii
hypocrita (Bembidium), 48
Hypolimnas, xiii, 62, 70, 71, 76, 79, 82, 83, 84, 88, 89, 100, 108, 109, 117, 125, 134, 264, 265, 268
hyppasia (Trigonodes), 109
hyppoclus (Symbrenthia), 95, 97, 98, 99
hyriaria (Synegiodes), 93
Hystrichopsylla, xxvii
Iambrix, 126
ianthis (Ogyris), 270, 271, 282, 289, 290, 292
iapygia (Melanargia), 42
ibalioides (Bassus), 436
ibericum (Bembidium), 46, 48
icarus (Lycæna), 41, 42, 379
,, var. celina (Lycæna), 379
ictis (Aphnæus), 85
ida (Epinephile), 376
Idæa, 99, 108, 130, 132
idmo (Ogyris), 269, 271, 273, 274, 275, 276, 280, 289, 290, 292
Ilerda, 65, 66, 70, 74, 81, 82, 93, 97, 134
ilicis (Orchestes), 49
,, (Thecla), 42
,, var. mauritanica (Thecla), 377
ilithyia (Biblia), 108
,, (Hypanis), 108, 119, 142
Illaphanus, xlviii, 365
illuminatella (Argyresthia), xlvi
Ilybius, 51
immanata (Polyphasia), 68
Imogen, 337, 338
imperialis (Cyria), lxvii
,, (Riptortus), 351
inachis (Kallima), xxxiii, 96
inangulata (Ericeia), 110
incanus (Brachyderes), 49
inceptaria (Bilactis), 113
incisus (Homoporus), 424, 428, 434
inclusa (Dasychira), 132
incoloralis (Pyrausta), 77
incondita (Metachrostis), 129
inconspicua (Pentatoma), 357
incredibilis (Iridopsis), 254
indecora (Bombycopsis), 322
indica (Pyrameis), 65, 69, 70, 80, 82, 93, 94, 111, 113
indigestana (Tortrix), 234
indistans (Mycalesis), 89, 92, 94, 99, 135, 140, 141
indra (Hiposcritia), 95
ines (Melanargia), 374
infusum (Megalocœlum), 50
inica (Yphthima), 107, 113, 141
inostentata (Panagra), 222
,, (Paragyrtis), 222
insignis (Bassus), 419
,, (Notoreas), 221
instabile (Cyphodema), 50
interjunctalis (Cledeobia), 392
interlectum Zonosoma), 96
interrupta 'Creatonotus), 126
,, (Microplax), 50
interruptus (Homoporus), 433
interstitialis (Bothrideres), 48
ione (Teracolus), lvii
iota (Plusia), 41
iphioides (Cœnonympha), 41, 42
Iphita, 343
iphita (Precis), 70, 81, 82, 98, 99, 113, 117, 121, 125, 139, 140
iracundus (Harpactor), 46
iridis (Lixus), 52
Iridopsis, 254, 262
iris (Apatura), xviii
Isamia, 137

ischnocyma (Notoreas), 221
ismene (Melanitis), 89, 92, 95, 109, 114, 135, 136, 140, 141, 142
isocrates (Virachola), 101
isodactyla (Platyptilia), 40
isoleuca (Notoreas), 221
Isomira, 45
Ixias, 70, 79, 80, 83, 84, 92, 93, 96, 98, 99, 101, 103, 104, 108, 115, 116, 127, 134, 139, 140, 141, 142, 143
jacchus (Philotherma), 318
jacintha (Diadema), 70
Jamides, 98, 131
janira (Epinephele), 94, 135
janthina (Gastroidea), 46
japonicum (Orthetrum), 135
jasius (Charaxes), 373
jasonia (Hestia), 133
javanica (Tessaratoma), 126
jesous (Lampides), 379
Jugurthia, 399
jumba (Neptis), 110
juniperi (Gonocerus), 50
juno (Platylomia), 200
jurtina, var. fortunata (Epinephile), 376
juvenculus (Dorylus), 100
Kallima, xxxiii, 93, 97
kallimon (Spindasis), 254, 262
Karsandra (Zizera), 70, 71, 73, 74, 102, 108, 121, 133
kashmirensis (Vanessa), 65, 66, 69, 80, 82, 93, 94, 134
,, (Zygæna), 72
klugi (Pantodinus), liii.
kollari (Pademma), 91, 137
kydippe (Ptochiomera), 346
Labidostomis, 45
lachesis (Melanargia), 42
,, var. canigulensis (Melanargia), li
,, var. cataleuca (Melanargia), 41, 42
Lachnæa, 49
laciniata (Phyllomorpha), 52
lacordairei (Steropus), 42, 43
lactea (Raparna), 110
ladon, var. pseudargiolus (Cyaniris), 99
Læmophlæus, liv
Læmosthenes, 47, 48
Læosopis, 41, 42
læta (Serenthia), 50
,, (Terias), 70, 95, 101, 103, 105, 106, 107, 134, 139, 141, 142, 143
lætatorius (Bassus), 425, 431
lætitia (Euryphene), 251
lævigatus (Miris), 50
Lagria, 49
Lahea, 319
laius (Chilades), 79, 101, 103, 119
lalage (Hiposcritia), 93, 94, 141
l-album (Leucania), 383
lamia (Pierella), 185
laminata (Cuspicona), 357
Lampides, 41, 42, 90, 92, 95, 96, 98, 99, 109, 117, 118, 119, 120, 126, 127, 379
lampros (Bembidium), 43
Lampyris, 45
lanka (Cyaniris), 130, 132
Laphygma, 384
laqueatus (Oxytelus), 44
Larcynia, 47, 48
Lasiocampa, 41
lasti (Lycænesthes), 253, 258
laterale (Bembidium), 46, 48
lateralis (Camptopus), 52
,, (Homoporus), 432
lathonia (Argynnis), 40, 42, 65, 69, 374
,, var. issæa (Argynnis), 66, 68, 81
lathriopa (Trachypepla), 237
laticarpus (Promethus), 429, 436
latifrons (Microdon), xlvii
latreilli (Callopistria), 385
latus (Corymbites), 45
Lechriolepis, 318, 326
lefebvrei (Erebia), xlix, 17
,, var. intermedia (Erebia), xlix
,, var. pyrenæa (Erebia), xlix
Leistrotrophus, 44
Leistus, 46, 47
Lema, 45
lemolea (Spalgis), 253
lemonias (Precis), 66, 68, 70, 79, 80, 81, 82, 84, 88, 89, 99, 100, 104, 105, 106, 109, 119, 120, 134, 139, 140, 141, 142
lemur (Onthophagus), 44
lentalis (Olybama), 132
lepidus (Hydroporus), 51
leporina (Neottiglossa), 50
Leptidia, 40
Leptocoris, 350
Leptocorisa, 350
Leptoglossus, 352
Leptura, 43, 45, 47, 49
Lepyrodes, 95
Lesteva, 44
Lethe, xliii, 94, 97, 128, 132, 134
Leucania, 383
leucocephalus, var. steganoides (Strongylocoris), 46
leucocera (Celænorrhinus), 95
leucocyanea (Philia), 360
,, var. ebenina (Philia), 360

leucocyanea (Scutellera), 360
Leucoma, 96
Leucophasia, 79, 88
leucoxesta (Stenoptilia), 232
levana (Araschnia), xxiv, xxv
,, (Lymanopoda), 188, 190
levenna (Beralade), 320
Libellula, 120
libyssa (Liptena), 253
Libythea, 95, 125
libythea (Appias), 76, 139
,, (Terias), 66, 70, 99, 101, 103, 109, 121
lichenis (Lema), 45
Licinus, 44
lifuana (Cicada), 328
,, (Tibicen), 329
,, (Ueana), 328
lifuanus (Oxycarenus), 347
ligea (Erebia), 17
lignipcrda (Hylurgus), 51
limacodes (Cochlidion), xxiv, xxv
Limenitis, xliii, 66, 88, 89, 101, 129
Limnas, xxvi, 72, 73, 75, 78, 80, 84, 87, 89, 90, 91, 92, 97, 98, 100, 104, 105, 106, 108, 109, 113, 115, 118, 120, 123, 132, 133, 135, 137, 138, 263–268
Limnebius, 44
limniace (Tirumala), 73, 75, 87, 89, 90, 91, 100, 109, 117, 118, 123, 124, 138
Limnius, 48
Limnometra, 341
Limnoxenus, 51
limoniella (Goniodoma), xlviii
Limonius, 45
lineata (Deilephila), 386
lineatum (Graphosoma), 50
lineatus (Carabus), 43
lineola (Cimex), 360
,, (Tectocoris), 360, 362
lineolatus (Adelphocoris), 50
lineosa (Synegiodes), 93
linguarius (Pterochilus), 404
Liodes, 48
liodes (Lycænesthes), 253
Lionotus, 410–415
Liptena, 252, 253, 262
littoralis (Prodenia), 100, 102
,, (Thisoicetrus), 81
lituratus (Hydroporus), 51
livida (Leptura), 49
lividalis (Hypena), 386
lixella (Coleophora), xlvii
Lixus, 52
Lochmæa, xxxi
longælytrata (Lesteva), 44
longipes (Homoporus), 423, 426, 432
longiseta (Megalyra), 396
longiventris (Homoporus), 428, 434
Lopus, 50
loreyi (Leucania), 383
loxotis (Borkhausenia), 241
Loxura, 90, 92, 126
lucasi (Melanargia), 374
lucida (Amara), xvi
,, (Tarache), 385
,, var. albicollis (Tarache), 385
Luciola, 106
luctuosa (Atheta), 48
,, (Tarache), 385
luctuosis (Macroplax), 348
lugubre (Callidium), 158
lunaris (Copris), 48
,, (Ophiusa), 385
lunata (Artaxa), 71
,, (Staria), 50
lunicornis (Didineis), lxv
Luperus, 46
luridipennis (Psylliodes), xlvi
lusitanica (Labidostomis), 45
lusitanicum (Malacosoma), 46
lusitanicus (Brachyderes), 49
,, (Cryptocephalus), 42, 45
,, (Heliopates), 45
luteolata (Opisthograptis), 387
luteolus (Hoplopus), 406
,, (Odynerus), 406
lutescens (Camptobrochis), 50
Luteva, 341
Lycæna, ii, xliii, xlvi, xlix, l, 39, 41, 42, 81, 82, 111, 379, 380, 393
Lycænesthes, 253, 258, 262
lycaon, var. lupinus (Epinephile), 376
,, var. mauritanicus (Epinephile), 376
Lycophotia, 383
Lygæus, 46, 50, 52, 343, 348, 349, 350, 352
Lygistopterus, 47, 49, 52
lyllus (Cœnonympha), 376
Lymanopoda, 188, 190
Lymantria, 386
Lymexylon, xlvi
lysimon (Lycæna), 379
Lytta, 42, 45
macclounii (Charaxes), 251
machæristes (Orocrambus), 224
machaon (Papilio), xliii, 70, 75, 203, 213, 371
,, var. asiatica (Papilio), 69
Machimus, iv
macleayanus (Papilio), xviii
macleayi (Illaphanus), 366
macrocephalus (Carabus), 42, 43
Macroglossa, 81, 387

macrophthalma (Orthostira), 46
Macroplax, 50, 348
Macropsis, 334
Macrothylacia, lii, 390, 393
maculata (Epeira), 5
maculatus (Hotinus), 126
,, (Promethus), 436
maculipes (Sehirus), 50
maderensis (Gonepteryx), xxxvii, xxxix
mæra (Pararge), 40, 375
maha (Zizera), 70, 71, 74, 76, 81
,, var. diluta (Lycæna), 82
,, ,, (Zizera), 66, 73, 74, 76
major (Quartinia), 399
Malachius, iv
Malacosoma, lxix, 46, 391
malia (Lymanopoda), 188
malvæ (Hesperia), 41
,, var. malvoides (Syrichthus), xxxv
malvata (Cidaria), 389
Mamestra, 383
mandata (Mycalesis), 121, 143
mandibularis (Acrognathus), xxxi
Marasmia, 77
margaritacea (Cassida), 50
margaritosa (Lycophotia), 383
marginalis (Dytiscus), 51
,, (Porthesia), 77
marginatus (Hydroporus), 51
,, (Syromastes), 52
marianne (Ixias), 70, 79, 80, 83, 101, 103, 104, 108, 115, 116, 139, 140, 141, 142
maritimus (Beosus), 50
marmoratus (Gastrimargus), 83
marmottani (Cleonus), 52
maro (Ampittia), 119
marshalli (Beralade), 321
,, (Mimacræa), 252
,, (Yphthima), 92, 98, 99, 114
martini (Rihana), 198
Maruina, 297
maso (Lymanopoda), 188, 190
mathias (Parnara), 71, 83, 85, 117, 126
maura (Eurygaster), 50
mauritanicus (Thestor), 378
maxima (Gonepteryx), xxxviii, xxxix
maximus (Phalacrus), 48, 51
meade-waldoi (Cœnonympha), 377
mechanitis (Notoreas), 221
Mecyna, 40, 112, 392
Medon, xxvii
medus (Calysime), 125
meeki (Ogyris), 271, 278, 289
megacephala (Acronycta), 384
megæra (Pararge), 65, 67, 135, 136, 375
Megaloceræa, 50
Megalocœlum, 50
Megalopus, xviii
Megalymenum, 353
Megalyra, lx, 395, 396
megamera (Ganoris), 137
Meganotum, 126
Megasemum, 146, 147, 148, 161, 164
megaspiloides (Eysarcoris), 357
megaspis (Homoporus), 428, 435
Megymenum, 353, 354
melæna (Castalius), 253
melampus (Rapala), 83, 85, 86
melanamma (Borkhausenia), 240
Melanargia, li, 39, 40, 41, 42, 374
melanaspis (Promethus), 429, 435
melaneus (Caduga), 95
Melanitis, 89, 92, 94, 95, 109, 114, 135, 136, 138, 140, 141, 142
melanocephala (Cymindis), 42, 44
melanocephalus (Cymus), 50
melanodonta (Titanoptilus), 248, 249
melanoides (Parantica), 95
melanomera (Meganotum), 126
Melanophthalma, xlvi
melanops (Lycæna), ii, iii
,, var. wheeleri (Lycæna), iii
melanoptera (Megalyra), 395, 397
Melanotus, 45, 49, 51
melas (Erebia), xviii, xlix, 17
melete (Ganoris), 137
Meligethes, 51
melipona (Megalopus), xviii
Melitæa, xliii, lii, 73, 74, 373
meliturga (Scoparia), 228
Meloë, 45
membranaceus (Aradus), 342
,, (Cimex), 352
,, (Leptoglossus), 352
,, var. orientalis (Brachyrhynchus), 342
memnon, var. agenor (Papilio), 96
memorata (Psilocambogia), 98
menaka (Tagiades), 114
menapia (Neophasia), xxi, xxii
menthastri (Chrysomela), 46
meone (Pararge), xxviii, xxix
meridionalis (Phytocoris), 50
merione (Ergolis), 90, 97, 101, 125
mesentina (Belenois), lvii, lxvi, 65, 67, 70, 71, 74, 76, 77, 79, 80, 82, 103, 104, 105, 106, 107, 134, 137, 144
Mesosemia, ii
Messaras, 127
Metachrostis, 79, 129
metadelta (Izatha), 238
,, (Semiocosma), 238
metallica (Scutellera), 362
metallicus (Pedilophorus), 42, 44

Metamorpha, 117
Metaporia, xxi
meticulosa (Brotolomia), 384
metirius (Hypocista), xviii
Metopoceras, 384
mexicanus (Criocephalus), 145, 154, 159, 164
Microdon, xlvii
microdora (Diptychophora), 227
Microdynerus, 415
Microplax, 50
Micrositus, 49
Mictis, 352
midamus (Euplœa), 5
,, (Isamia), 137
millefolii (Anthaxia), 49
Mimacræa, 252
mimas (Euptychia), 187, 190
Mimela, 98
Mimetica, liii
minutissimus (Bidessus), 51
Miris, 50
misippus (Hypolimnas), xiii, 76, 83, 84, 88, 89, 100, 109, 117, 134, 264, 265, 266, 267, 268
,, var. inaria (Hypolimnas), 109, 264, 265, 266
Misolampus, 47, 49
mixtus (Mononyx), 338
mnesichola (Xanthorhoe), 220
mniszechi, var. maroccana (Satyrus), 375, 393
mœsta (Corixa), 50
Monanthia, 50
monilis (Læmophlæus), liv
Mononyx, 338
montana (Narmada), 128
montanellus (Platyderus), 48
montanus (Criocephalus), 158, 159
,, (Cyrtonus), 47, 50
monteironis (Lycænesthes), 253
monticola (Homoporus), 432
montivaga (Cosmopsaltria), 200
montrouzieri (Megymenum), 354
,, (Zangis), 356
morœi (Cryptocephalus), 46, 50
morbillosus (Carabus), lxv
Mordella, 45
Mordellistena, 49
moricei (Panurgus), lii
Mormolyce, lxxii, lxxiii
Morpho, xviii
moschata, var. thoracica (Aromia), 43, 45
multicolor (Bassus), 425, 432
,, (Homoporus), 432
Munza, 192, 202
muricata (Nothorrhina), 51, 157
murina (Isomira), 45
murinus (Leistotrophus), 44
Musca, 70
mutabilis (Adonia), 50
mutata (Serica), 48
muticus (Anthophagus), 42, 44
mutilis (Megalyra), 395
Mycalesis, 83, 89, 92, 94, 98, 99, 100, 114, 115, 121, 125, 135, 138, 140, 141, 142, 143, 251, 252, 262
Myelois, 392
Mylabris, 70, 84
Mylothris, liv, lviii, lix
Myodocha, 350
myrmecophila (Tasmanica), 368
Myrmeleon, xlvi, lxxvi
myrrhina (Dryadaula), 243
mystacatus (Cryptocephalus), 46
Nabis, 46, 50, 52
Nacaduba, 71, 133
nadina (Huphina), 94, 98, 141
Næmatopus, 352
Nais, 293
napæa (Dryadaula), 244
napi (Ganoris), 71, 91, 101, 117, 137
,, (Pieris), lxxv, 40, 66
nareda (Yphthima), 78
narendra (Hiposcritia), 111, 112
Narmada, 117, 128
nasuta (Truxalis), 71, 73, 134
natalensis (Pycna), 197, 202
navale (Lymexylon), xlvi
Nebria, 42, 43, 48
nebrioides (Deltomerus), 42, 43
neglectus (Rhizotrogus), 51
,, (Zabrus, 42, 43
Neides, 52
Nemeophila, 41
nemoralis (Bassus), 431
,, (Haptoderus), 46, 48
Neoclytus, xvi
Neope, xliii
Neophasia, xx
Neopithecops, 90, 92
neoridas (Erebia), 28
Neottiglossa, 50
Nephele, 71, 77
Nepheronia, 88, 90, 107, 117, 127
Neptis, xliii, 2, 5, 6, 8, 81, 82, 94, 95, 96, 97, 98, 99, 107, 109, 110, 111, 117, 121, 125, 127, 129, 130, 132
nereis (Pachymerus), 347, 363
neriene (Zeritis), 252
nerine (Erebia), 17
nerissa (Huphina), 66, 70, 79, 84, 91, 96, 97, 98, 99, 101, 102, 105, 106, 115, 119, 120, 127, 137, 139, 140, 141, 142, 143, 144

Neuroctenus, 342
neuwaldeggiana (Mordellistena), 49
newarra (Rhodia), 93
nicholli (Erebia), 9
nietneri (Cethosia), 125
niger (Homoporus), 422, 427, 434
nigra (Eumenes), 400
nigricornis (Homoporus, 433
nigrina (Oxypoda), v
nigripes (Catacanthus), 354
,, (Cimex), 354
,, (Limonius), 45
nigrita (Geodromicus), 47, 48
,, (Hydræna), 51
,, (Pterostichus), 43
,, (Silpha), 44
nigritarsus (Homoporus), 435
nigriventre (Philorhinum), 44
,, (Promethus), 429, 435
nigrofasciatus (Luperus), 46
nigrosuturatus (Cleonus), 45
nigrovenosa (Trypheromera), 127
nilgiriensis (Badacara), 112
,, (Colias), 112, 138
niobe (Argynnis), 42
nipalensis (Ganoris), 72
,, (Gonepteryx), xxxvii, xxxviii, xxxix
Niphanda, xliii
niphe (Argynnis), 73, 74, 83, 97, 112, 113, 128, 132, 134
niphonica (Cidaria), 67
nitidulum (Bembidium), 43
nitidus (Limnebius), 44
nivalis (Baris), 42, 45
,, (Synuchus), 42, 43
nobilis (Gnorimus), xxxi
,, (Œdemera), 45
noctiluca (Lampyris), 45
,, (Pipiza), 438
noctuella (Nomophora), 112
nomentis (Scoparia), 231
Nomophora, 112
noreia (Nacaduba), 71, 133
nostrodamus (Gegenes), 74, 76
,, (Parnara), 381
notatus (Pissodes), 52
Noteraula, 232
Nothorrhina, 51, 146, 157
Notiophilus, 42, 43
Notodonta, iii
Notoreas, 220, 221, 222
nubilus (Criocephalus), 154, 158, 159
numata (Heliconius), li
numida (Jugurthia), 399
nupta (Catocala), xlv
Nychitona, 79, 87, 89, 92, 97, 101, 110, 115, 120, 127
nycteris (Rhopalopsyche), 69
Nymphula, 392
nyseus (Talicada), 110, 111, 126, 129, 130, 131
Nysius, 46, 50
Nyssanga, 125, 132
oberthuri (Alæna), 252
,, (Catocala), 384
,, (Cephalallus), 148, 163
obliquata (Beralade), 320
oblongata (Eupithecia), 389
oblongus (Limnoxenus), 51
obscura (Ocinaropsis), 317
obscurus (Aphodius), 43, 44, 48
obsitalis (Hypena), 386
obsoletus (Criocephalus), 145, 154, 158, 159, 164
obtecta (Cosmopsaltria), 330
,, (Dundubia), 330
,, (Tettigonia), 330
obtusella (Coleophora), xlviii
occulta (Xanthorhoe), 220
ocellaris (Dinoderus), xxvii
ocellea (Eromene), 106
ochrata (Acidalia), li
ochrearia (Aspilates), 387
Ocinaropsis, 317
Oenerostoma, xlvi
18-guttata (Halyzia), 50
octomaculatum (Bembidium), 51
ocularis (Sthenarus), 50
Odontopera, lxvi
Odynerus, 406–415
Œcophora, 239
Œcophylla, 279
Œdemera, 45, 49
œnone (Precis), 70, 74, 81, 82, 84, 100, 102, 104, 106, 109, 120, 139, 140, 141, 142
œnospora (Crocydopora), 224
,, (Sporophyla), 224
Ogyris, xxvi, 269–292
olane (Ogyris), 272, 283, 289, 291, 292
oleracea (Ganoris), 137
,, (Mamestra), 383
oleraceum (Emydema), 50
Olibrus, 48
Oligochroa, 71, 79
Oligota, ii
olivacea (Phytodecta), 46
Olybama, 132
Olyra, 323, 326
Omalium, 44
omichlias (Notoreas), 222
Omophlus, xxxi
omphale (Teracolus), lvi, lxi, lxii
Oncocephalus, 340
Oncopeltus, 349

Oncotylus, 50
Oncotympana, 201
Oniticellus, 48
onopordi (Hesperia), 381
Onthophagus, 44, 48
opalina (Athyma), 66, 68
Ophiusa, 384, 385
Opisthograptis, 387
orana (Procris), 391
orbitulus (Lycæna), xlix, l
,, var. oberthuri (Lycæna), xlix, l
Orchestes, 49
Oreopsyche, 391
Orgyia, 41, 181
orientalis (Sphinx), 79
Orina, 46
orithyia (Precis), 65, 66, 69, 70, 72, 73, 74, 76, 81, 82, 84, 100, 102, 103, 104, 105, 119, 133, 139, 140, 141, 142
ornatus (Bassus), 437
,, (Homoporus), 427, 433
Orneodes, 247
Ornithoptera, lxvii, 121, 123, 128
Orocrambus, 224
orœtes (Ogyris), 270, 272, 285, 286, 289, 291, 292
orontas (Ogyris), 269, 274, 275
Orsotriana, 99
Orthenches, 242
Orthetrum, 110, 135
Orthomus, 43
orthophanes (Compsistis), 243
Orthostira, 46
osiris (Chœrocampa), xxiii
ossium, var. insularis (Stenus), xlvi
ostrina (Eublemma), 385
otanes (Ogyris), 271, 275, 277, 289, 290, 292
Otiorrhynchus, 42, 45, 46, 49
otis (Zizera), 99, 102, 127
,, var. indica (Zizera), 71, 109, 119
Oxeoschistus, 189, 190
Oxycarenus, 347
Oxypoda, v
Oxytelus, 44
Pachygastria, 390
Pachymerus, 346, 347, 363
Pachypodistes, 245
Pachytelia, 40
Pachytomella, 46, 53
Pachytychius, 49
Pademma, 91, 137
Pælia, 247
palarica (Erebia), 9–35, 39, 40
palealis (Phlyctænodes), 392
palliatus (Hylastes), 49
pallidipes (Homoporus), 428, 435
pallipes (Trichomastix), 430
palustris (Notiophilus), 43
pammon (Papilio), 75, 77, 88, 90, 99, 100, 109, 114, 118, 120, 123, 127, 134
,, var. polytes (Papilio), 82
pamphilus (Cœnonympha), 40, 42, 72, 376
pampolis (Catochrysops), 258, 262
Panagra, 222
pandava, var. bengalia (Catochrysops), 88
pandellei (Trechus), 47, 48
pandora (Argynnis), 374
pandurus (Lygæus), 46, 50
panope (Papilio), 5
Panorpa, iv
Pantodinus, liii
Panurgus, lii, liii
paphia, var. anargyra (Argynnis), 41, 42
Papilio, xii, xviii, xliii, lxvii, 5, 7, 8, 69, 71, 74, 75, 77, 78, 80, 82, 83, 84, 88, 89, 90, 96, 99, 100, 103, 105, 106, 107, 108, 109, 110, 111, 113, 114, 116, 117, 118, 120, 123, 124, 127, 130, 133, 134, 203, 213, 216, 217, 251, 371
Paracymus, 51
paradelpha (Notoreas), 221
paradoxa (Heterogynis), 177, 178, 179, 180, 181, 183, 184
Paragyrtis, 222
paralekta (Kallima), xxxiii
Parantica, 95, 121, 123, 124, 133, 137
Pararge, xxviii, xliii, 40, 65, 66, 67, 135, 136, 138, 375
pancratii (Glottula), 383
parietum (Ancistrocerus), 410
,, (Odynerus), 410
parinda (Papilio), 110, 124
parisatis (Hipparchia), 73, 74, 135
,, (Satyrus), 72
parmata (Cercotmetus), 342
,, (Ranatra), 342
parmenio (Erebia), 13
Parnara, 71, 74, 83, 85, 117, 126, 380, 381
Parnassius, 40, 69
Paromalus, 47, 48
parumpunctatus (Corizus), 50
parvula (Lagria), 49
parvulus (Lionotus), 413
,, (Odynerus), 413
,, (Tachys), 48
pasiphaë (Epinephile), 376
patagiata (Pseudometa), 314, 326
patnia (Nyssanga), 125
pauli (Cleophana), 383, 393

paulina (Catophaga), 111, 115, 116, 123, 127, 128, 130, 134, 135, 137, 142, 143
paulinoi (Corymbites), 45
paullula (Sterrha), 110
pavana (Chrysophanus), 65, 66, 68, 81, 82
pavonia (Saturnia), vii, viii, ix, x, xi
pectoratorius (Bassus), 438
,, (Homoporus), 426, 432
peculiaris (Catochrysops), 253
Pedaliodes, 189, 190
Pedilophorus, 42, 44, 47, 48
pedunculatus (Microdynerus), 415
,, (Odynerus), 415
Peggioga, 336, 363
peletieraria (Cleogene), 39
pellitus (Balaninus), 49
Pelochares, 51
peltigera (Chloridea), 382
,, (Heliothis), 41
peñalaræ (Erebia), 17, 30
pendularia (Zonosoma), xxxii
penella (Heterogynis), 177, 178, 179, 180, 181
penicillata (Euptychia), 186, 187, 190
Peniscomus, 351
pennigeraria (Eurranthis), 387
,, var. chrysitaria (Eurranthis), 387
pentadactyla (Argyria), 227
Pentatoma, 354, 355, 356, 357
penthalea (Borkhausenia), 239
,, (Œcophora), 239
Pentila, 252
Perena, 102
Pericoma, 296, 297, 311
Perileptus, 43
periphæa (Xanthorhoe), 220
perius (Athyma), 73, 81
perobliqua (Beralade), 319
peronatus (Bassus), 438
perplexus (Pilophorus), 50
perpusillaria (Acidalia), 389
perseus (Calysisme), 125
,, (Mycalesis), 83, 89, 100, 114, 115, 125, 140, 142
petiolata (Eumenes), 129
phæoptila (Trachypepla), 236
Phalacrus, 48, 51
phalænoides (Psychoda), 311
phalanta (Atella), 65, 68, 70, 74, 76, 89, 100, 103, 104, 115, 129
Phalera, xxiv, 387
phalerias (Scoparia), 230
Phaneroptera, li
pharmactis (Borkhausenia), 241
phasianipennella (Gracilaria), 435
pheretes (Lycæna), xlix
Philereme, 67, 68
philerga (Soparia), 228
Philia, 359, 360, 362
philodice (Colias), xxix
philomela (Yphthima), 82, 89, 92, 95, 113, 114, 140
Philonthus, 44, 51
Philorhinum, 44
Philotherma, 318, 326
Philudoria, 315
Philus, 147
phineus (Euptychia), 187
phlæas (Chrysophanus), 66, 378
,, (Polyommatus), 41, 42
,, var. timeus (Chrysophanus), 65, 66
Phlyctænodes, 392
Phthorimus, 420, 425, 430, 436
Phycochus, xlviii, 367, 368
Phylacodes, 241, 242
Phyllobius, 42, 45
Phyllodecta, 46
Phyllomorpha, 52
Phyllyphanta, 334, 335
Phymata, 50
Physoderus, 339
Physopelta, 343
Phytocoris, 47, 50
Phytodecta, 46
piceum (Agathidium), 48
picitans (Homoporus), 435
picta (Pœcilocera), 72, 73
picteti (Eumenes), 400
pictus (Homoporous), 434
Pierella, 185
Pieris, xxxii, xlii, lxxiv, lxxv, lxxvi, 40, 101, 203, 371, 372
Piezostethus, 50
pigea (Pinacopteryx), xv, lviii, lxvi
pilata (Euptychia), 186
pilipes (Hydrotæa), vii
Pilophorus, 50
pilula (Byrrhus), 44
Pinacopteryx, xv, lviii, lxvi
pinastri (Syrphus), 432
pinetorum (Criocephalus), 151, 153, 155, 158, 164
pini (Aphanus), 46, 50
piniariella (Ocnerostoma), xlvi
pinicola (Læmosthenes), 47, 48
pipizæ (Bassus), 438
pisanus (Dytiscus), 51
Pissodes, 52
placida (Cupha), 125, 127
plagiata (Anaitis), 388
plagifera (Trypheromera), 96, 98
Planema, 251

planicollis (Licinus), 44
plantaginis (Nemeophila), 41
planus (Homoporus), 434
Plataspis, 362
Platycephala, 362
Platycerus, 43, 44
Platyderus, 48
Platylomia, 200, 201
Platynus, 43
Platypleura, 192, 193, 194
Platyptilia, 40, 231
Platystethus, 293
Plautia, 355
Plegaderus, 47, 48
Plemyria, 132
plinthina (Chloroclystis), 219
plistonax (Eurythene), 251
Plociomera, 346
Plotcia, 132
Plusia, 41, 385
Plusiotis, liii
Pochazina, 335
podagrariæ (Œdemera), 45, 49
podalirius (Papilio), 71, 371
,, var. feisthamelii (Papilio), 371
Pœcilocera, 72, 73
Pœciloscytus, 50
Pœcilus, 48
pœcilus (Dysdercus), 345, 346
,, (Pyrrhocoris), 346
poggei (Planema), 251
,, (Pseudacræa), xxvi, 251, 263–268
,, (Uranothauma), 253
Polistes, 73, 416
polita (Trichomastix), 430
politis (Borkhausenia), 240
polonicus (Criocephalus), iv, 158
polychloros (Vanessa), 40
Polydidus, 339
polydorus (Platypleura), 193
Polydrosus, 49
polygonalis (Mecyna), 40, 112, 392
polymena (Enchromia), 129
polymnestor (Papilio), 110, 118, 124
polymnia (Ueana), 329, 363
Polyommatus, 41, 42, 65, 71, 72, 74, 78, 85, 105, 106, 108, 109, 131, 134
Polyphasia, 68
Polyrrhachis, 1
polytes (Papilio), 7, 8, 75, 78, 89
polyxena (Thais), 203
Pomasia, 129
pomona (Catopsilia), 75, 84, 88, 89, 110, 115, 121, 122, 133, 138, 139, 140, 142, 143
pomona, var. catilla (Catopsilia), 107, 121, 133
pomonæ (Apion), 49
Pompilus, 81
pontebæ (Lionotus), 413
,, (Odynerus), 413
Pontia, xxi
populi (Smerinthus), 386
,, var. austauti ab. incarnata (Smerinthus), 386
porcatum (Steganomma), 365
porcatus (Brachytemnus), 49
porculus (Helophorus), 42, 44
porphyrella (Acrobasis), 392
porphyritis (Orthencha), 243
Porthesia, 77
prælata (Scirpophaga), 391
præstans (Liptena), 253
Pratapa, 85, 134
Precis, 65, 66, 68, 69, 70, 72, 73, 74, 76, 78, 79, 80, 81, 82, 84, 88, 89, 98, 99, 100, 102, 103, 104, 105, 106, 109, 113, 117, 119, 120, 121, 125, 133, 134, 138, 139, 140, 141, 142, 143, 144, 251
princeps (Venusia), 220
Priocnemicoris, 352
Prioneris, 97, 98, 141
Prionocyphon, liv
prochlora (Ascerodes), 234
Procris, 41, 391
procris (Limenitis), 88, 89, 101
Prodenia, 100, 102
producta (Phyllyphanta), 335
productata (Selidosema), 223
productus (Criocephalus), 158, 159, 160
profanus (Lygæus), 352
,, (Mictis), 352
,, (Næmatopus), 352
profunda (Proteodes), 236
prolixus (Actobius), 44
Prometheus, 421, 425, 429, 435, 436
prompta (Beralade), 320
pronuba (Agrotis), 382
pronubana (Tortrix), lxiii
Proselena, 234
Proteodes, 236
proterpia (Pyrisitia), xxxviii
Prothelymna, 234
protractus (Teracolus), 75, 139
Pseudacræa, xxvi, 251, 263–268
Pseudometa, 314, 326
Pseudoterpna, 389
Psilocambogia, 98
Psiloglossa, 400
psittaceus (Harpalus), 44
Psyche, 40, 181

Psychoda, xxx, 293–310
psylaria (Pomasia), 129
Psylliodes, xlvi
Pternistria, 353
Pterochilus, 403, 404, 405
Pterostichus, 43
Ptochiomera, 346
Ptychoptera, 298, 303
pubescens (Lachnæa), 49
,, (Staphylinus), 43, 44
pudica (Cymbalophora), 381
puellaris (Teracolus), 75, 79, 105, 139, 141
puera (Hyblæa), 83
puerta (Oxeoschistus), 190
pulchella (Deiopeia), 72, 81, 84, 109, 110
,, (Utetheisa), 382
pulchellus (Promethus), 429, 436
pulcher (Homoporus), 428, 435
pulchra (Lechriolepis), 318, 326
,, (Psiloglossa), 401
pulverulenta (Cicada), 199
pumilus (Homoporus), 428, 434
punctatus (Homoporus), 433
punctiventris (Homoporus), 426, 432
punctulata (Tephrosia), xxvii
punctulatus (Dytiscus), 51
,, (Homopterus), 42, 45
punctum (Catacanthus), 354
,, (Cimex), 354
pungata (Selidosema), 223
pungens (Rhyncocoris), 356
,, (Vitellus), 356
pupillaria (Ephyra), 389
purpuripennis (Carpocoris), 46, 50
pusillus (Brachyplatys), 362
,, (Ptinus), lxv
puspa (Cyaniris), 95
putli (Chilades), 83, 85, 103
Pycna, 191, 197, 202
pygialis (Rhizotrogus), 48
pygmæus (Cydnus), 359
,, (Geotomus), 359
,, (Olibrus), 48
Pyrameis, xi, xxviii, 65, 66, 69, 70, 72, 80, 82, 93, 94, 111, 113, 134, 373
pyranthe (Catopsilia), lv, 7, 71, 75, 79, 81, 85, 88, 89, 92, 99, 101, 105, 109, 115, 118, 119, 133, 134, 138, 139, 140, 141, 142, 143, 144
,, var. gnoma (Catopsilia), 70, 81, 85, 105
Pyrausta, 77, 84, 392
pyrenæum (Bembidium), 42, 43, 48
pyrenæus (Anthophagus), 44
,, (Barynotus), 45
,, (Corymbites), 45
pyrenæus, (Geotrupes), 43, 44
,, (Otiorrhynchus), 45
pyrenaica (Lycæna), xlix, l
pyrene (Ixias), 79, 80, 84, 92, 93, 96, 98, 99, 115, 134, 139, 140, 141, 142, 143
,, var. cingalensis (Ixias), 115, 127
,, var. evippe (Ixias), 93
pyri (Saturnia), vii, viii
pyriformis (Cneorrhinus), 46, 49
pyrina (Zeuzera), 391
Pyrisitia, xxxviii
pyrochroa (Dindymus), 345
,, (Dysdercus), 345
Pyrrhocoris, 346
pyrsophanes (Diptychophora), 228
quadrata (Verlusia), 50
4-costatum (Megasemum), 164
14-pustulata (Coccinella), 50
quadridens (Bolboceras), 104
4-punctata (Anthaxia), 51
quadripunctata (Laphygma), 384
,, (Phaneroptera), li
4-punctata (Zonabris), 49
4-pustulatus (Exochomus), 50
Quartinia, 399, 400
quercus (Bombyx), 435
,, (Lasiocampa), 41
,, (Orchestes), 49
,, (Thecla), 42
Quiroguesia, 73
quisquiliarius (Philonthus), 51
5-punctatus (Cryptocephalus), 46, 49
Rahinda, 82, 125
rama (Arhopala), 97
,, (Libythea), 95, 125
Ranatra, 342
ranga (Athyma), 95
ransonnettii (Caprona), 117, 129
rapæ (Ganoris), lvi, lix, 87, 91, 101, 137
,, (Pieris), xxxii, lxxiv, 40, 67, 105, 203, 216, 217, 371
Rapala, 83, 85, 86, 90, 96
Raparna, 110
Raphidoglossa, 402
rectilineata (Olyra), 323, 326
recurvalis (Hymenia), 71, 77, 85
reflexus (Homoporus), 423, 428, 434
regensteinensis (Sitones), 45
regia (Gonometa), 313, 326
regina (Teracolus), 251
regulus (Lionotus), 412
,, (Odynerus), 412
remba (Huphina), 94
remotata (Idæa), 99
repanda (Taragama), 390
revoili (Munza), 192, 202

reyi (Gynandrophthalma), 42, 45
reynosæ (Athous), 42, 45
Rhagium, 161, 163, 164, 167, 168, 169
Rhagonycha, 42, 45
rhamni (Gonepteryx), xxxvi, xxxvii, xxxix, xl, xli, lxxv, 372
,, var. nipalensis (Gonepteryx), 64, 66, 80
Rhamphus, 49
Rhaphygaster, 356
rhea (Pierella), 185
Rhizotrogus, 43, 44, 48, 51
Rhodaria, 41
Rhodia, 93
Rhodostrophia, 389
Rhopalocampta, 7
Rhopalopsyche, 69
Rhynchites, 45, 52
Rhyncocoris, 356
Ricania, 335
ridleyanus (Papilio), 251
Rihana, 198
riparia (Hydræna), 51
Riptortus, 350, 351
Rivula, 132
roboris (Læosopis), 41, 42
robusta (Eurythecta), 233
robustus (Riptortus), 351
rodriguezi (Heterosternus), liii
rohria (Lethe), 94, 97
rosa (Crenis), 251
,, (Philotherma), 318
rosimon (Castalius), 117, 120, 133
rostrata (Ælia), 50
ruber (Capsus), 50
rubi (Callophrys), 378
,, (Macrothylacia), lii, 390
,, digramma (Macrothylacia), 390, 393
rubida (Lagria), 49
rubra (Leptura), 49
rubripes (Harpalus), 44
rufescens (Aphodius), 44
,, (Gastroplakæis), 314, 326
,, (Raphidoglossa), 402
ruficornis (Grammoptera), xvii
,, (Homoporus), 428, 434
rufifrons (Dacne), liv
rufipes (Aphodius), 44
,, (Bassus), 419
,, (Stenobothrus), xlvi
,, (Tropicoris), 50
rufiventris (Bassus), 420
,, (Megalyra), 395
,, (Zootrephus), 425, 430, 431
rufoænea (Chrysomela), 50
rufofemorata (Chrysomela), 42, 46
rufomarginatus (Leptocoris), 350
rufonotatus (Homoporus), 435
rufus (Telephorus), 45
rugosus (Enicmus), 47, 48
,, (Nabis), 46, 52
rumicis (Acronycta), 384
rumina (Thais), 371
,, var. canteneri (Thais), 371
runeka (Mycalesis), 98, 99
,, (Orsotriana), 99
rüppellii (Mylothris), lviii
rustica (Adimonia), 432
rusticus (Criocephalus), 145, 148, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 162, 163, 164, 172
,, (Machimus), iv
,, var. ferus (Criocephalus), 158
rutilus (Agonoscelis), 355
,, (Cimex), 355
saba (Glutophrissa), lix
sabina (Orthetrum), 110
sacraria (Sterrha), 388
Sadaka, 191
sahlbergi (Corixa), 52
Salda, 50, 345
salsala (Iambrix), 126
sandycias (Chloroclystis), 219
sanguinalis (Rhodaria), 41
sanguineus (Lygistopterus), 47, 49, 52
Saprinus, 44
sarcoxantha (Gymnobathra), 239
sarpedon (Papilio), 7, 8
Saturnia, vii
Satyrus, xviii, xliii, lii, 26, 41, 42, 67, 72, 135, 374, 375, 393
saucia (Agrotis), li
saucius (Plagaderus), 48
saussureii (Hierodula), 6
,, (Lionotus), 410
,, (Odynerus), 410
saxatilis (Lygæus), 52
scabricollis (Misolampus), 47, 49
,, (Pachytychius), 49
scabriculus (Homoporus), 432
scabrosus (Homoporus), 434
scævoides (Chamæsyrphus), xlvii
schakra (Pararge), xxviii, 65, 67
schaufussi (Saturnia), viii, x
Schœnobius, 110
schreberi (Cerocoma), 47, 49, 52
,, (Onthophagus), 48
schrenkii (Pararge), xliii
sciathis (Mycalesis), 251
Scirpophaga, 391
Scolopendra, 293
Scoparia, 228–231
scopulata (Euptychia), 186, 190

scrutator (Aphodius), 43, 44, 48
scutellaris (Capsus), 46
,, (Promethus), 421, 429, 435
Scutellera, 359, 360, 361, 362
segetis (Euxoa), 382
Sehirus, 50
seidlitzi (Zabrus), 46, 48
selene (Argynnis), 40
Selenia, xxiv, xxix
selenophora (Athyma), 95
Selidosema, 223, 388
selousi (Mycalesis), 251
semele (Satyrus), xviii, 42, 67, 135, 374
semicanaria (Thamnonoma), 388
Semiothisa, 79, 104, 110
semistrista (Corixa), 52
semivittatum (Apion), lxv
Sena, 319
sena (Ilerda), 65, 66, 70, 74, 81, 82
senator (Philia), 362
senecionis (Nysius), 46
separata (Clovia), 330
Sepedon, lxxiii
septentrionis (Danais), 123, 131
,, (Tirumala), 127, 134, 135
seraphina (Platypleura), 193
Serenthia, 50
Serica, 48
sericea (Oxypoda), v
sericeus (Cryptocephalus), 46
Serinetha, 350
serratulæ (Hesperia), 381
serricornis (Prionocyphon), liv
Sesia, 109
setifrons (Polydrosus), 49
severina (Belenois), liv, lvii, lix, lxvi
severini (Platypleura), 194
sexdentatus (Tomicus), 51
sexguttatus (Calocoris), 46
sexmaculata (Chrysocoris), 359
,, (Scutellera), 359
sexmaculatus (Cryptocephalus), 50
,, (Eucorysus), 359
sexpunctata (Lachnæa), 49
,, (Psychoda), xxx, 293–311
sexpunctatus (Anchomenus), 43
,, (Platynus), 43
shakra (Pararge), 136, 138
shuckardii (Megalyra), 395
sibylla (Limenitis), 66
sicanaria (Rhodostrophia), 389
sichelii (Eumenes), 400
sidæ (Dysdercus), 345
,, (Mylabris), 70, 84
sideraspis (Scoparia), 231
sideritis (Noteraula), 232
siderodeta (Borkhausenia), 240, 241
signatus (Homoporus), 429, 435
Silpha, 44
silvana (Heliconius), li
simillimus (Bombus), 72
simplex (Beralade), 321, 322, 326
,, (Chilena), 322
Simulium, 309, 311
sinapis (Leptidia), 40
,, (Leucophasia), 79, 88
singalensis (Cyaniris), 67, 68, 69 129
sinuata (Rahinda), 82, 125
siterata (Cidaria), 389
Sitones, 45
sjostedti (Taragama), 316
skotios (Catochrysops), 259, 262
Smerinthus, 386
sobrina (Nebria), 42, 43
,, (Zonabris), 45
socialis (Eucheira), xix, xxi, xxii
solieri (Euplexia), 384
Solpuga, 108
solstitialis (Rhizotrogus), 44
sophistes (Crambus), 225
sordida (Abraxas), 130
,, (Philotherma), 318, 326
sorhageni (Zeritis), 252
Spalgis, 126, 253
speciosus (Teracolus), lxvi
spectrum (Apopestes), 385
specularia (Corymica), 130
specularis (Lionotus), 411
,, (Odynerus), 411
sphærula (Coptosoma), 362
Sphindus, 47, 49
Sphinx, 79
spicata (Platypleura), 192
Spilostethus, 348
spilothrys (Celœnorrhinus), 129
spinarum (Athalia), 437
Spindasis, 94, 119, 254, 255, 262
spini (Saturnia), viii, x
spinifer (Platycerus), 43, 44
spinifera (Euxoa), 104, 382
spiniger (Centrocoris), 50, 52
spiricornis (Hoplopus), 406
,, (Odynerus), 406
splendens (Philonthus), 44
splendida (Euricania), 335
,, (Flata), 335
,, (Ricania), 335
,, (Scutellera), 362
splendidum (Stilbum), 106
Spondylis, 47, 49
Sporophyla, 224

squalidus (Lygæus), 349
stahli (Ceratopterus), xviii
Stalagmostethus, 348, 349
Staphylinus, 43, 44
Staria, 50
statilinus (Satyrus), 42
Steganomma, 365, 366
stellatarum (Macroglossa), 387
Stenobothrus, xvi, xvii
Stenopteryx, lxvi, 112, 113
Stenozygum, 356
Stenus, xlvi, 42, 44
stephensi (Illaphanus), xlviii, 365, 367
Steropus, 42, 43, 46, 48
Sterrha, 110, 388
Sthenarus, 50
stigmatica (Euptychia), 186, 190
Stilbum, 106
stockerus (Chrysocoris), 126
stolida (Grammodes), 385
stomoides (Bembidium), 43
stormsi (Catochrysops), 253
strabo (Catochrysops), 83, 85, 90, 108, 109
Strachia, 355
stragulata (Leptura), 47, 49
straminea (Noteraula), 232
Strangalia, 43, 45
stratiotata (Nymphula), 392
Strepsicrates, 232
striatum (Asemum), iv, 145–176
striatus (Helops), vi
strigator (Bassus), 438
,, (Homoporus), 428, 434
Strongylocoris, 46
strophæa (Argyria), 225
Strophosomus, 42, 45, 49
stygne (Erebia), lii, 9–35, 39, 40
,, var. bejarensis (Erebia), 11, 15, 16, 30, 31, 34
,, var. hispanica (Erebia), 13, 15, 17, 18, 31, 34, 35
,, var. peñalaræ (Erebia), 15, 18, 27, 31, 33, 34, 42
,, var. pyrenaica (Erebia), 16
Stygnocoris, 46
Suastus, 87, 109
suavis (Philonthus), 51
subalbitaria (Semiothisa), 110
subapterus (Coranus), 50
submarginalis (Scoparia), 231
submarginata (Leucoma), 96
subsericeata (Acidalia), 389
sulcator (Promethus), 429, 435
,, (Zootrephus), 430
sulcatum (Rhaphygaster), 356
sulcipennis (Phycochus), xlviii, 368
sulphureus (Cteniopus), 45
sundevalli (Homoporus), 427, 434
superbus (Lygæus), 50
suspiciosus (Homoporus), 434
suturalis (Brachyderes), 52
,, (Cordylomera), xlv
,, (Lochmæa), xxxi
swaha (Aulocera), 64, 68, 69, 135
sylvatica (Cicindela), 43
Symbrenthia, 95, 97, 98, 99
Symphædra, 107
Synchloë, lix
synclinalis (Notoreas), 220
Synegiodes, 93
Synuchus, 42, 43
syriacus (Cephalocrius), 149, 164
,, (Criocephalus), 145, 146, 149, 150
Syrichthus, xxxv
Syromastes, 52
szepligetii (Megalyra), 396
Tachypus, 48
Tachyris, 97, 99, 112, 117, 141
Tachys, 48
Tæniocampa, xvii
tagalicus (Arictus), 342
,, (Brachyrhynchas), 342
Tagiades, 114
Talicada, 110, 111, 126, 129, 130, 131
talpæ (Hystrichopsylla), xxvii
tanaceti (Cucullia), 383
Taphropeltus, 50, 52
Tarache, 385
Taragama, 315, 316, 326, 390
tarsatorius (Homoporus), 427, 433
Tarucus, 71, 73, 76, 79, 81, 83, 103, 104, 106
Tarundia, 335
Tasmanica, 368
taurica (Gonepteryx), xxxvii, xxxviii, xxxix, xli
Tauroscopa, 227
Tectocoris, 360, 362
Telchinia, 103, 109, 115, 119, 120, 133
Telephorus, 42, 45
telephus (Papilio), 111, 116, 124, 127
telicanus (Lampides), 41, 42, 379
,, (Tarucus), 76, 81, 83, 103, 106
Telicota, 6, 79, 83, 85, 90
Temnochila, 51
tenebraria, var. wockearia (Dasydia), xviii
tenebrosus (Melanotus), 45
tenuiscapa (Xylocopa), 126

Tephrinia, 79, 108, 110
Tephrosia, xxvii
Teracolus, xv, xxxviii, lvi, lvii, lxi, lxii, lxvi, 71, 75, 78, 80, 103, 104, 105, 106, 107, 108, 117, 119, 134, 139, 141, 142, 144, 251, 372, 393
teredon (Papilio), 111, 130
Terias, xliii, 61, 66, 67, 68, 69, 70, 71, 72, 73, 75, 79, 81, 82, 83, 84, 87, 89, 92, 95, 98, 99, 101, 102, 103, 104, 105, 106, 107, 109, 111, 113, 119, 121, 122, 129, 130, 132, 134, 139, 140, 141, 142, 143, 144
Teriomima, 253
terlootii (Neophasia), xx, xxii
terricola (Piezostethus), 50
Tessaratoma, 126
testacea (Hydræna), 51
testaria (Amygdaloptera), 387
tetralunaria (Selenia), xxix
Tetropium, lxvii, 146
Tettigonia, 330, 332, 333
Tettigonides, 332
Thais, v, 203–218, 371
Thalattoscopus, 334, 363
Thamnonoma, 388
thaumas (Adopæa), 380
Thecla, 42, 377
theophrastus (Lampides), 379
,, (Tarucus), 71, 73, 79, 103, 104
Therapha, 46, 50
thersamon, var. omphale (Chrysophanus), 378
Thestor, 378
thestylis (Prioneris), 97, 98, 141
thetodes (Gymnobathra), 239
thetys (Curetis), 90, 134
Thisoicetrus, 81
thoracica (Elis), 88
thoracicus (Homoporus), 434
thranias (Borkhausenia), 240
thyelia (Symphædra), 107
Thylacites, 47, 49
thymi (Nysius), 50
thyodamas (Cyrestis), 96
thyridias (Scoparia), 229
thysa (Belenois), lvii
tibetanus (Criocephalus), 155, 159, 164
tibialis (Cryptocephalus), 46
,, (Heterocordylus), 46
Tibicen, 329
Ticherra, 97
tigrinus (Corizus), 50
Timarcha, 42, 46, 47, 50
Tinægeria, 73
Tinea, 235
tipularius (Neides), 52
tirrhæa (Ophiusa), 384
Tirumala, 73, 75, 87, 89, 90, 91, 100, 107, 109, 117, 118, 123, 124, 127, 134, 135, 138
titan (Gonometa), 313
Titanoptilus, 248
tithonus (Epinephele), 40, 42
Titubœa, 49
toboranus (Papilio), 251
toletanum (Bembidium), 48
Tomicus, 51
topha (Teracolus), xv, xvi
torquatum (Anthobium), 44
Tortrix, lxiii, 234
touhilimasa (Precis), 251
Trabala, 66
Trachypepla, 236, 237
transfugus (Helophilus), lxv
transversa (Corixa), 52
trapezalis (Marasmia), 77
trapezitis (Tauroscopa), 227
Trechus, 47, 48
triangularis (Brachycoleus), 50
Trichobyrrhulus, 48
Trichodes, 49
Trichomastix, 424, 425, 430
Trichoptilus, 249
tricinctus (Bassus), 425, 431
triclera (Scoparia), 230
tricolor (Pentatoma), 354
trifolii (Pachygastria), 390
Trigona, xviii
Trigonodes, 109
trimeni (Cooksonia), 257, 262
,, (Epamera), 252
,, (Mylothris), lviii
tripars (Aufidus), 332
tripunctatus (Lionotus), 412
,, (Odynerus), 412
Triscædecia, 247
tristalis (Hypena), 67
triste (Callidium), 158
tristrigoa (Earias), 71, 79
tritici (Agrotis), lxi
trivia (Melitæa), 73, 74
Tropicoris, 50
truncata (Polyphasia), 68
truncatellus (Otiorrhynchus), 46, 49
Truxalis, 71, 73, 134
Tryphæna, lxvii
Trypheromera, 96, 98, 127
Tryphonides, lxxvi
tuberculata (Hydrotæa), vii
tuberculifer (Phyllobius), 42, 45
tyndarus (Erebia), 39, 40
,, var. ottomana (Erebia), 39

typhæus (Geotrupes), 44
tytia (Caduga), 96
Ueana, 328, 329, 363
ulicis (Apion), 45
uliginosus (Elaphrus), 43
ulyssiponensis (Micrositus), 49
umbrata (Platylomia), 201
umbratilis (Philonthus), 51
umbrosa (Euptychia), 186
Umjaba, 196, 202
unca (Hydrelia), 109
undularis (Elymnias), 88, 89, 92, 98, 115
unicolor (Hister), 44
unifasciatus (Pœciloscytus), 50
uniformis (Asura), 129
uniguttatus (Dieuches), 110
Uranothauma, 253
urinator (Gyrinus), 51
urticæ (Vanessa), xliii
Utetheisa, 382
vagata (Acropteris), 97
Vanessa, xviii, xxix, xliii, 40, 65, 66, 69, 72, 80, 82, 93, 94, 107, 112, 113, 134, 136, 373
vardhana (Cyaniris), 66, 68
varia (Lechriolepis), 319
variabilis (Cantao), 361
,, (Phytodecta), 46
,, (Scutellera), 361
,, (Zonabris), 49, 52
varicoxa (Bassus), 425, 431
variegata (Libellula), 120
,, (Philereme), 67, 68
variegatus (Hoplopus), 408
,, (Odynerus), 408
varipes (Phytocoris), 50
varius (Hydroporus), 51
varmona (Neptis), 95, 99, 107, 109, 110, 111, 113, 117, 121, 125, 127, 129, 130, 132
varunana (Chilades), 79, 101
vaucheri (Cœnonympha), 377, 393
velleda (Hepialus), 41
velutina (Vespa), 73
velutinus (Chlænius), 44
venosa (Bombycopsis), 322, 323
venustus (Dynamenais), 344
,, (Ectatops), 344
Verlusia, 50
verma (Lethe), 95
versicolor (Pelochares), 51
verticillata (Diapria), lxv
vesicatoria (Lytta), 42, 45
Vespa, 72, 73, 417
Vesperus, 49, 51, 52
vetustus (Heliconius), li
villica (Arctia), 381
villica, var. konewkai (Arctia), 381
villosella (Pachytelia), 40
viminalis (Bombycia), 383
vinula (Dicranura), 387
viola (Pseudometa), 314
violæ (Telchinia), 102, 103, 109, 110, 115, 119, 120, 133
Virachola, 101
virescens (Œcophylla), 279
,, (Oncotympana), 201
virgaureæ, var. miegii (Polyommatus), 41, 42
viride (Cuspicona), 357
,, (Pentatoma), 357
viridulus (Stenobothrus), xvii
vishnu (Trabala), 66
vitellinæ (Phyllodecta), 46
Vitellus, 356
vittatus (Baracus), 130, 131
,, (Betarmon), 44
,, (Cryptocephalus), 42, 46
vittiger (Phytocoris), 50
vorax (Apion), 49
vuillefroyi (Nebria), 46, 48
vulcanus (Spindasis), 94, 119
wallengreni (Beralade), 320
waterhouseri (Ogyris), 271, 273, 275, 289
willcyi (Adrisa), 358
,, (Geocoris), 349, 363
,, (Tettigonia), 333
woodlarkianus (Lygæus), 343
xanthaspis (Homoporus), 428, 435
xanthindyma (Cosmophila), 132
Xanthorhoe, 220
Xenarthra, xxvi
xiphia (Nychitona), 79, 87, 89, 92, 101, 110, 115, 120, 127
xuthus (Papilio), xxxiv
Xylocopa, 126
Xylotrupes, 132
Yanga, 194, 195, 202
Yphthima, 72, 78, 82, 87, 88, 89, 92, 95, 98, 99, 107, 111, 113, 114, 121, 125, 133, 134, 138, 139, 140, 141, 142
ypsilon (Agrotis), 382
Zabrus, 42, 43, 46, 48
zalmora (Neopithecops), 90, 92
Zanclognatha, 385
zaneka (Conepteryx), xxxviii, xxxix
Zangis, 356
zapateri (Erebia), 28
Zegris, lxxv
zelæa (Eurytheeta), 233
zelleri (Parnara), 380
Zemeros, 95, 97
Zeritis, 252

Zeuzera, 391
ziczac (Notodonta), iii
zinckenella (Etiella), 108
Zizera, 66, 70, 71, 73, 74, 76, 81, 83, 99, 102, 108, 109, 119, 121, 127, 133
zochalia (Belenois), lviii
Zonabris, 42, 45, 47, 49, 52
Zonosoma, xxxii, 96
Zootrephus, 424, 425, 430
zopherana (Strepsicrates), 233
zosine (Ogyris), 269, 270, 278, 289, 290, 292
,, -duaringa (Ogyris), 280, 289
,, -magna (Ogyris), 281, 289
Zygæna, 72, 391

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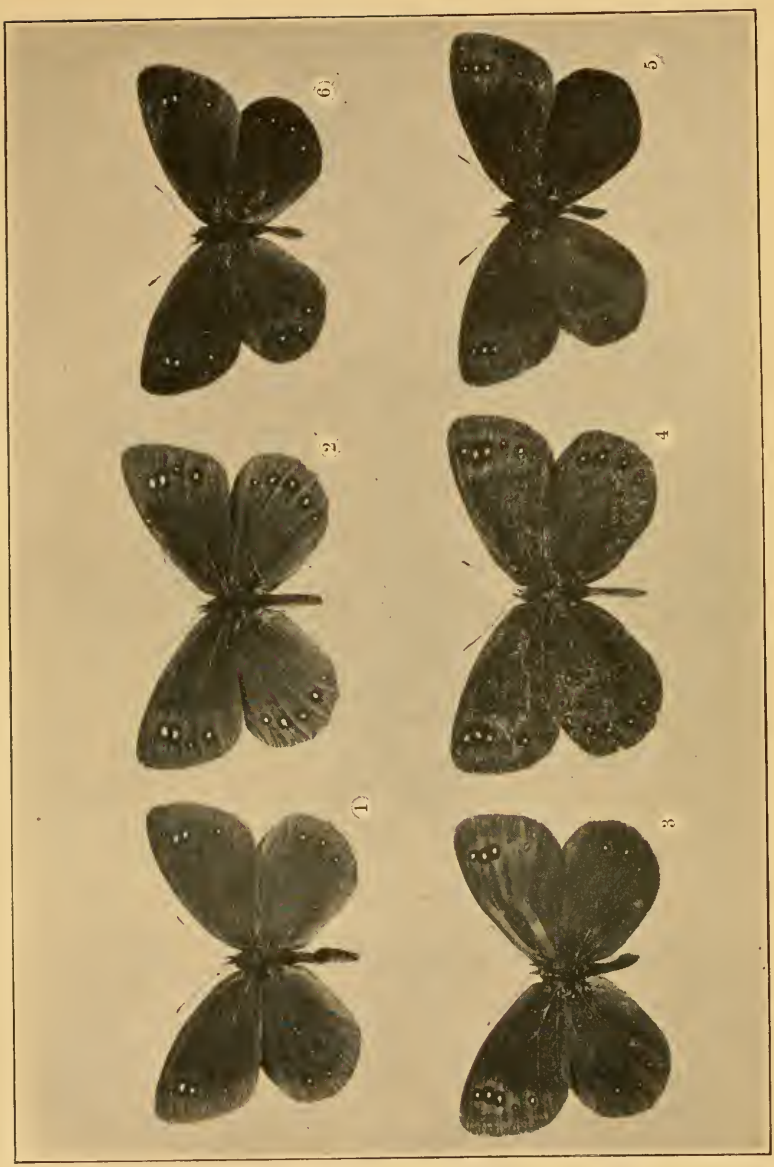

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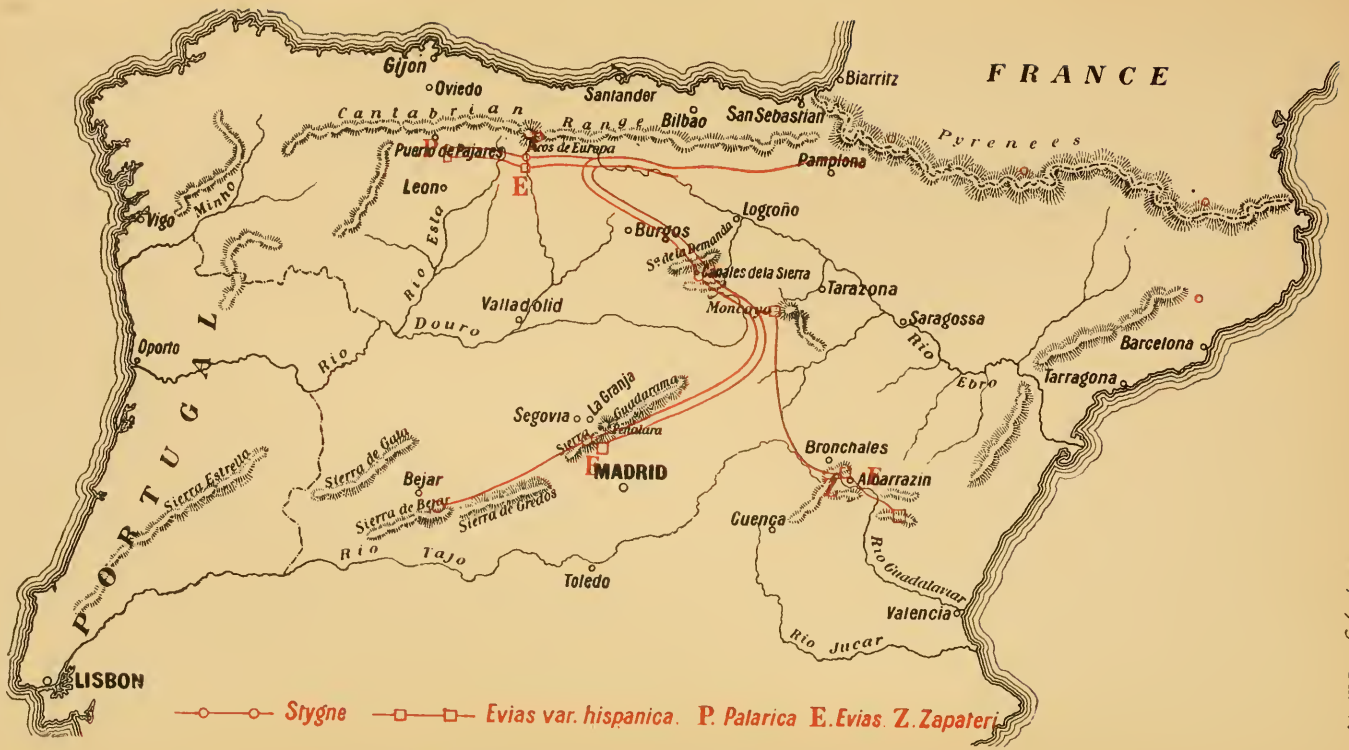

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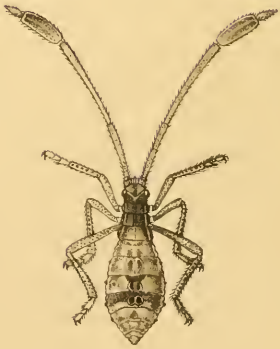

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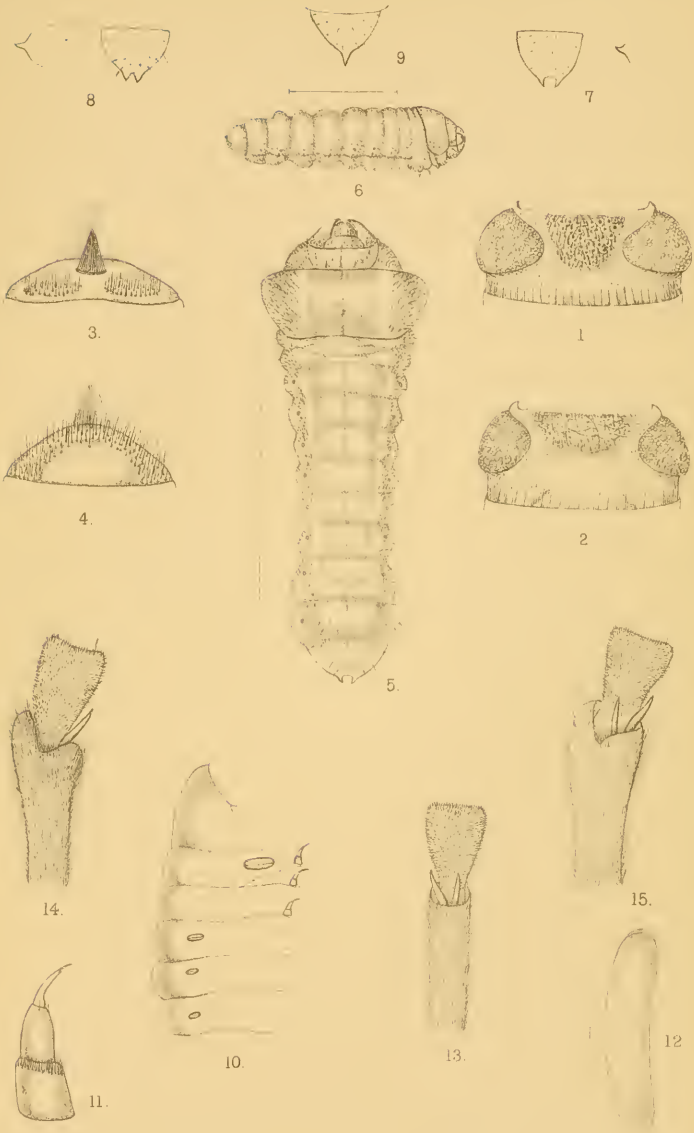

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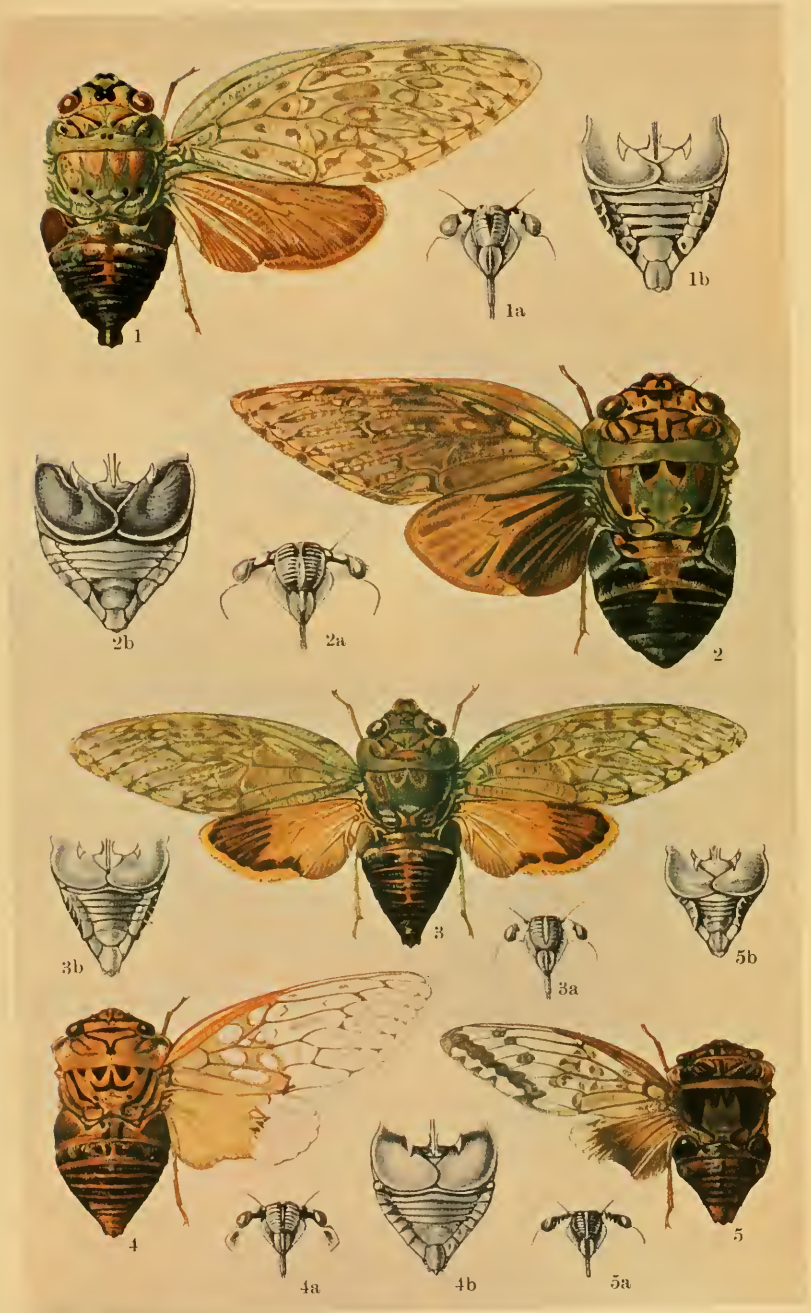

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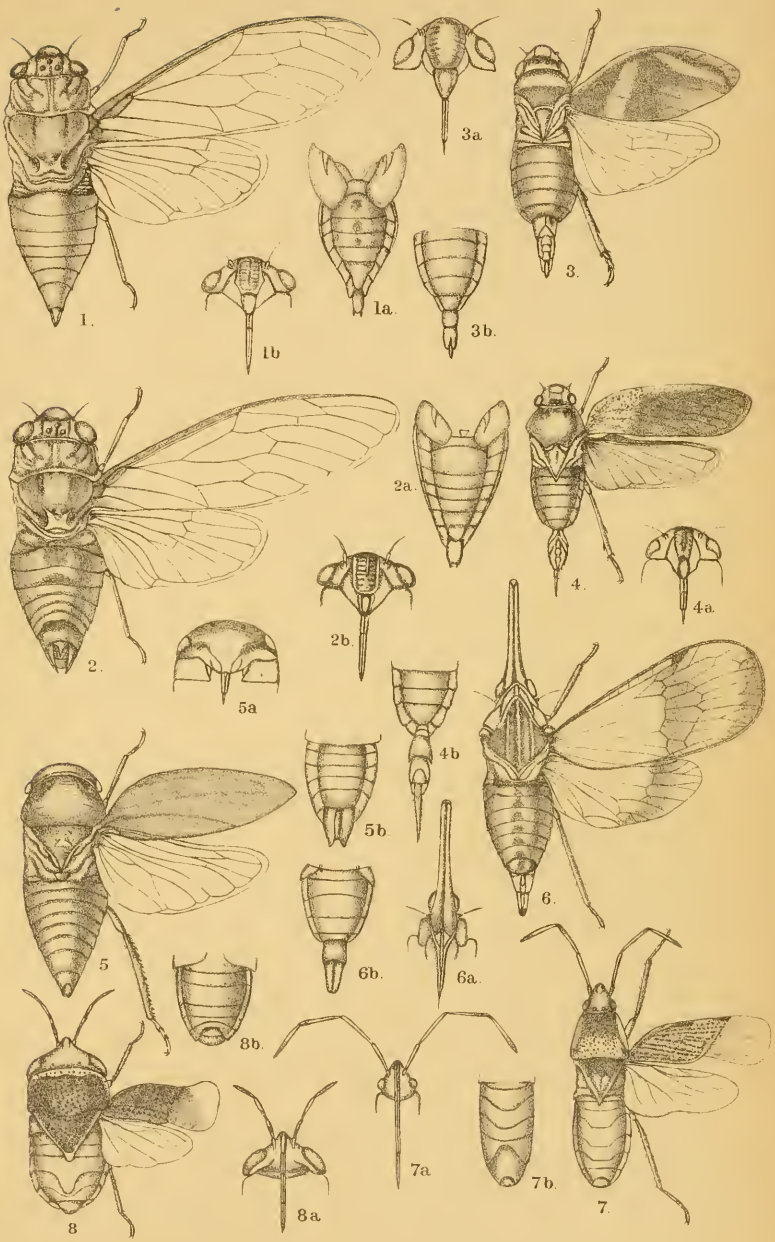

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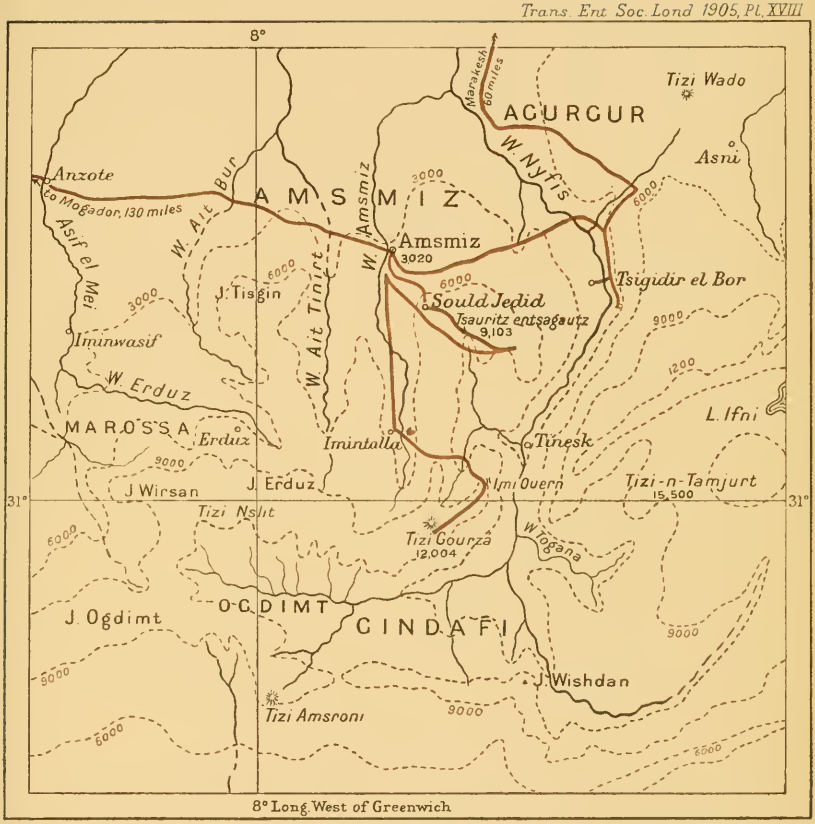

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